The

Electrical Review

VOL. C. MARCH 11, 1927. No. 2,572.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman: H. ALABASTER.

Technical Editor: A. H. ALLEN, M.I.E.E. *Joint Managing Directors:* G. H. ALABASTER. E. A. GATEHOUSE M.I.E.E., A.M.INST.C.E. *Commercial Editor:* A. H. BRIDGE.

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Telegraphic Address: "AGEEKAY, CENT., LONDON," Code, A B C. Telephone No.: Central 7072 (Three Lines).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

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Industrial Psychology.

THE National Institute of Industrial Psychology, whose report for 1926 is briefly abstracted elsewhere in this issue, has now for six years been carrying on work which is constantly increasing in scope and importance. The president is the Earl of Balfour, K.G., and on the council are enrolled many men of the highest eminence in science, commerce, and industry.

It may seem strange that only in modern times has the importance of the study of the human mind attained to even partial recognition, although the injunction: "Know thyself!" is classic, and the aphorism: "The proper study of mankind is man" is almost proverbial. But the fact is that only in modern times has scientific method been brought to bear upon this subject, which is, moreover, one of exceptional difficulty owing to the impossibility of precise measurement of mental qualities and characteristics—and accurate measurement is the very soul of science. Nevertheless, during this century immense progress has been made, and experimental methods have been developed to a degree that enables conclusions to be reached with a large measure of certainty and to command the confidence of the onlooker. Almost as important as the examination of mentality is the subject of "motion study" in particular occupations; but the latter is rather a mechanical question relating to the body of the worker, and of general application, whilst the former relates to the characteristics of the individual mind without regard to its mortal shell—the contrast between physical and psychic.

"Industrial psychology" is a branch of the larger subject which is of extreme practical importance, for by its intelligent application, with the aid of motion study, the efficiency of the worker can be greatly improved, his happiness and comfort can be secured, and his remuneration economically increased whilst fatigue is minimised. All these factors are of great weight in these days when continuity of output and minimum cost of production are essential to cope with foreign competition, whilst continuity of employment and maximum remuneration are necessary to the maintenance of peace in industry.

We believe that the work of the Institute deserves the warm and practical support of every firm engaged in industry and of every social worker. The more

rapidly its operations can be extended, the sooner will they bear fruit. We are glad to see that it is gaining in appreciation and that its resources are growing; but still its work is conducted on a scale absurdly small in comparison with the vast and fertile field that awaits the tilling, and we hope that donations and subscriptions will flow into its funds at an ever-increasing rate. It should be remembered, too, that its experts are at the service of those who seek advice on the reorganisation of their manufacturing processes, the staffing of their works, and the improvement of working conditions, at moderate fees. It is incorporated as a scientific association not for profit; in its own way it fills a similar position to the National Physical Laboratory, and in due time we hope to see a National Psychology Laboratory come into existence.

Aerial Navigation Lights.

Illuminating engineers have been much concerned with the best methods of lighting streets, the dominant consideration nowadays being the safe guidance of traffic, and for many years the design of coast and ships' lights has been a specialised subject, but in the present century the new problem of lighting the "highways of the air" has arisen. An interesting review of recent work in this field was presented in a paper recently read by Mr. H. N. Green before the Illuminating Engineering Society. The author confined himself to aerodrome lights, but this in itself is now quite a big subject. Considerable ingenuity has been expended on the lighting of landing places, the design of beacons, the arrangement of boundary-lights, &c., and many different forms of lamps are being pressed into service. In remote spots where electricity is not available, acetylene is commonly used for beacons, but the flexibility of electric lighting is well illustrated by the diversity of appliances used. It is common knowledge that electric gasfilled lamps of very high power have been employed for this work, but in many districts the neon light, owing to its unmistakable colour and capacity for quick-flashing, is even more useful. The neon beacon at the Croydon Aerodrome seems to have proved signally successful, and the installation of neon tubes to mark out the landing area is also under consideration. Mr. Green devoted a section of his paper to the problem of flying in fog. At present, pilots do not attempt flight when the visibility is unduly low, but they may be unexpectedly caught in dense fog, or mist. In this case other electrical devices, such as the "leader cable" and directional wireless, come to their aid.

Faults in Flexibles.

In view of the rapid increase in the use of portable electrical appliances in the household, it is surprising that no progress is made towards eliminating a trouble which, though no great matter in itself, must prove irksome to the non-technical persons who constitute the vast majority of users—namely, breakdown of the flexible leads, which happens all too often.

Within our own experience, with a variety of portable apparatus, the faults have been confined entirely to the parts of the flexible subject to frequent bending—*e.g.*, where they are attached to plugs, fires, &c.—and are mainly due to fatigue of the fine stranded wires, resulting in brittleness and eventual fracture, or short circuit due to the broken ends. The inclusion of three steel wires in the strands mentioned by a correspondent some time ago should be beneficial, not, we think, on the score of strength, with which we have no fault to find, but because their relative stiffness prevents the flex from bending at so sharp an angle, and thus distributes the distress over a greater length of the flex.

Material improvement might easily be effected in the same direction by easing the curvature of the entry into plugs, &c. In some cases apparently no thought has been given to the matter at all; the flex enters and is tightly clamped in a hole with sharp edges, concentrating the distress on a length of, say, a quarter of an inch, and inviting early trouble. By attention to such points we have found it easy to reduce faults in flexibles to a trifling number; and faults of other descriptions are rare indeed. Incidentally, stout flexible with plenty of cotton lapping is more durable than thin stuff.

The education of the housewife in effecting simple repairs of this kind, which is one of the aims of the Electrical Association for Women, is a very laudable purpose; but prevention still remains better than cure, and this is a weak point to which, we think, manufacturers might with advantage devote much more attention than they do.

The Truth About Electric Cooking.

In its latest publication (E.D.A.661) the British Electrical Development Association rebuts some rather absurd accusations which have been made against electric ovens as used by bakers and confectioners. For instance, a periodical supporting gas interests recently alleged that there was a movement among Swiss users of electric baking ovens to revert to gas owing to the production of ozone by the elements, which flavoured the food. It is pointed out that a glowing element cannot possibly generate ozone, apart from the fact that in all up-to-date ovens the elements are totally enclosed. The Association quotes a letter to the Electrical Review from a firm of bakers in which the "ozone" *canard* is ridiculed. Further evidence is a statement by the Association of Swiss Master Bakers and Confectioners (representing 5,300 bakers out of a total of 6,000) to the effect that in Zurich alone 30 per cent. of the ovens are electric, and that in 15 years' time 4,000 ovens out of 6,000 in use in Switzerland will be electrified. But perhaps this Association has not yet heard of the "movement" before-mentioned; nor, apparently, have the Swiss supply authorities. Is it possible that the "movement" originated in the befumed imagination of a gas enthusiast? And does this enthusiast want it both ways: non-ventilating electric fires and ventilating electric ovens?

The Birmingham Frequency Problem.

In our "Notes" to-day we reproduce an interesting statement from the *Birmingham Post*, from which it will be seen that the new power station which the Corporation of Birmingham is about to erect is to contain generating plant of 25 cycles frequency. We do not wish to read into this announcement more than is justified; but it is undoubtedly of great significance.

It has been repeatedly emphasised, in and out of Parliament, that if the frequency is to be standardised, the change must be made at the earliest possible moment; the longer it is delayed, the higher will be the cost. The erection of a new power station of capital importance with a frequency of 25 cycles implies that the change in the Birmingham area is indefinitely postponed. Mr. R. A. Chattock and his Committee are to be congratulated on carrying their point—that to spend millions on the conversion would be a waste of money—and we have no doubt that their worries are immensely lightened by this decision.

The suggestion that when the plant attains the end of its economic life it will be an inexpensive matter to replace it with machines of the standard frequency is beside the point. The real difficulty of conversion is met not in the power station, but in the distribution system and on consumers' premises—a very different matter.

As precedent is of great influence in public affairs, we may safely conclude that while the many minor examples of non-standard frequency may undergo standardisation, the big systems operating at 25 and 40 cycles will be left in peace for a time.

Theatre Lighting.

The new complete electric-lighting installation for both the auditorium and stage at the Alhambra Theatre, London, involves some novel features in the remote control of the auditorium lighting from the stage.

THE recent completion of the new stage-lighting installation at the Alhambra Theatre, London, was the final stage of a scheme for rewiring the whole of the building which was commenced a few years back. The old installation, 100-V, 3-wire, was considerably out of balance, and the way in which the old wiring was run rendered it impracticable to effect a reasonable balance of the load. It was equally impracticable to change over the old work on to the outers at 200 V, as the existing wiring was too old to stand the higher pressure, and no intermission of performances and rehearsals could be entertained. It was therefore decided to install modern systems at 200 V, involving the use of high c.p. units for both the auditorium and the stage.

Three main lighting groups serve for the general lighting of the auditorium. Two of these consist of fittings fixed in alternative positions over the seats on the various tiers, and are supplied from entirely independent intake mains housed in separate fireproof chambers at the front of the house (Leicester Square). The third lighting group is made up of decorative totally-enclosed hexagon opal fittings arranged in front of the tiers. By suitable dimming arrangements, very effective lighting is obtained, and with the whole lighting "on," the result is particularly pleasing; some idea of this may be gained from fig. 1.

Although the third lighting group is also supplied from the front of the house, it is controlled for switching and dimming from the stage, the equipment involving some novel features. In order to overcome the difficulty brought about by the L.C.C. Regulation prohibiting circuits from the auditorium passing through the proscenium wall, an ingenious system of electro-mechanical operation has been adopted. The dimming apparatus, designed by the Watford Electric and Mfg. Co., Ltd., and involving the movement of a metal arm for short-circuiting, or otherwise, a number of carbon resistance brushes, is operated by specially designed switches, the essential movements of which are rigidly attached to, but insulated from, the armatures of plunger relays operated from the stage. Fig. 2 shows the remote-control relay switches, the relay and switch portions of which are wholly and separately enclosed. Fig. 3 shows the Watford dimming equipment. The speed with which the resistance is either inserted or withdrawn is adjustable by means of an eddy-current disk brake. Pilot lamps to the circuits remotely controlled from the stage are fixed in an iron box, with a glass cover, let into the proscenium wall in a convenient position for the switchboard operator. In addition to the stage control, two-way and intermediate switching for the third group is provided on the auditoroum ground floor, from where it can at any time be switched on full in a case of emergency.

The dimmers for the general-lighting groups are so arranged that normally the lamps are at about half-light, thus leaving sufficient illumination in the auditorium during performances for the lighting of the gangways. Additional switches provide for further resistance during kinematograph trade shows, when a greater degree of darkening of the auditorium is required. The decorative lighting is dimmed right out while the performance turns are on.

Fig. 1.—Alhambra Auditorium Lighting.

The L.C.C.'s approval is required when it is desired to light any part of the auditorium by the stage current, and the only fitting which is supplied in this way is the large centre fitting suspended from the dome. It is interesting to note that this "Sun Burner," fig. 4, is an old converted gas fitting, and is now equipped with eight 1,000-W gasfilled lamps.

For circulation and cleaning during the day, certain places, such as the staircases and exits, require artificial light, and a group of pilot and exit lights is separately wired and switched for these positions.

Another group provides for other positions where artificial light is only wanted on dark days, the lamps being separately wired and switched as sub-pilots. As it is essential that during performances there should be no possibility of these lights being left out, special switching arrangements are provided. An emergency switch also permits the sub-pilots to be used when required during the day. The exit and pilot lights are wired up to two-way and intermediate switches so that they can be controlled from the stage door and all floors of the auditorium. A large number of lights are also provided in the basement, and a separate circuit serves for power and heating. In addition, an entirely separate supply cable serves for lighting and heating in the dressing rooms, boiler house, and workshops. The new auditorium scheme embraces some 258 points and a total loading of 25 kW, as against 550 points and 35 kW in the old installation. The wiring is run in screwed conduit throughout.

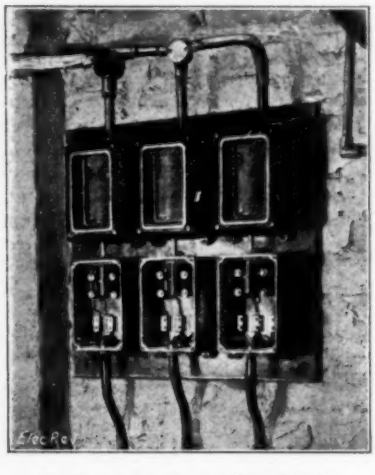


Fig. 2.—Remote Control Relay-Switches.

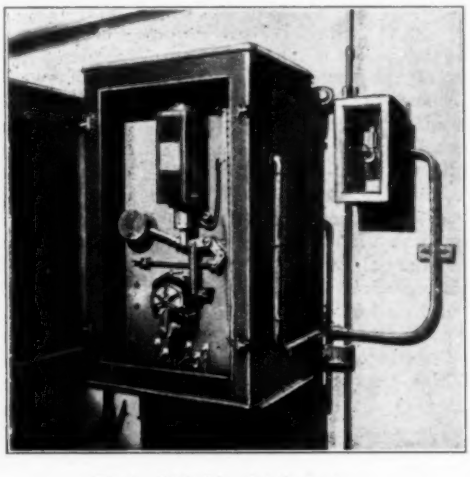


Fig. 3.—Light-Dimming Apparatus.

For the stage lighting, battens of the magazine type have been employed, replacing many of the open type previously in use, and the resulting improvement in illumination and in the attractive colour effects now obtainable is most marked. The battens are of a special design to secure strength, rigidity, and durability, and employ specially constructed wiring troughs to give easy access to the wiring and lampholders. It is interesting to note that the wiring for the battens is taken right up to the grid and not to the flies, thus affording greater clearance and means of access. All the branch circuits from the control board to the battens are brought to ironclad connection boxes on the grid. These serve as link boxes only, one to each batten, and are designed along the lines of the P.O. telephone link boxes.

The loading of the battens and float is 46 kW. The main battens are 42 ft. long, each carrying 33 white lamps, 17 reds, 17 blues, 16 ambers, and 1 pilot. An additional batten about to be added at the back of the stage is specially designed for tilting, so as to throw the light either in front of or behind a scenic drop. This will bring the total loading of the battens and float up to 52 kW.

Arrangements are made by the provision of a main change-over switch and links, so that in the event of the supply failing on the Charing Cross Electric Supply Co.'s theatre main, current can be quickly obtained from the company's network main.

The relative merits of metallic and liquid resistance dimmers had to be considered in respect of the space available, the provision and ventilation of a fireproof chamber, regulating capacity and cost. It was found that to meet the conditions of limited space and the very fine grading necessary, metallic dimmers would be much more costly than liquid ones, and the latter were decided upon. A few metallic dimmers are, however, used for groups of lights which are regulated "right out" or "right in," as required, without check. The liquid dimmers and arc resistances are housed in a specially constructed fireproof chamber two floors below the stage. Very great difficulties were encountered in conveying the large number of tracker wires from the dimmer regulators on the control gallery to the pots, and the highly satisfactory manner in which these have been overcome is evidenced by the ease with which the regulators are operated. Every dimming circuit has a pilot lamp arranged above the regulating wheel, indicating to the operator the degree of dimming.

The switchboard for the stage installation, which is arranged on a specially constructed control gallery above the stage floor, is in three sections, the operating board, the fuseboard, and the return board. The whole of the fuses for the stage lighting are brought to the middle section, fig. 5 right, thus avoiding the great inconvenience previously experienced by fuses being situated in remote and inconvenient positions. The fuses for any section are clearly indicated and can be easily and quickly identified for replacement, resulting in great economy of time over what was previously possible.

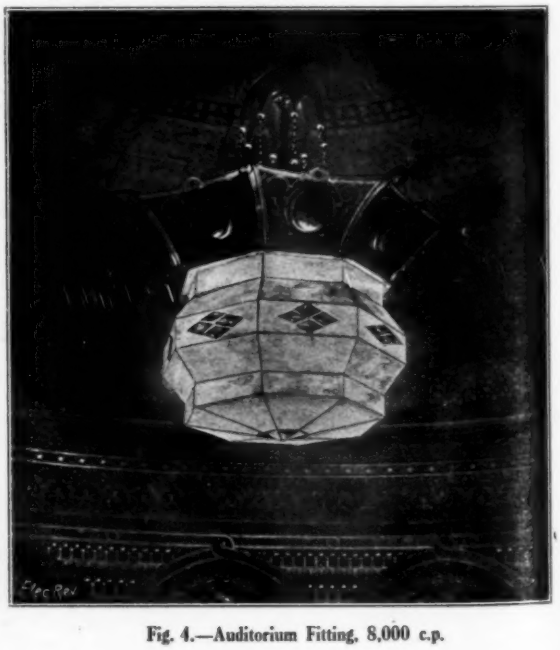


Fig. 4.—Auditorium Fitting, 8,000 c.p.

The operating board, fig. 5 left, is arranged on the negative or earthed side of the system, thereby minimising the risk of accidental shock to the operator. A s.p. knife switch, in addition to a link fuse for each circuit, is provided on this board. On the positive or return board, fig. 6, are installed electrically operated contactors. These are governed by ordinary s.p. tumbler switches on the operating board, the system being arranged so that a master switch and contactor may be operated to put the whole of the lighting "on" or "off" circuit. The necessary

equipment for operating the dimmers is accommodated by a separate board facing the main operating switchgear; the end of this is shown in fig. 5. Pilot lights for the various circuits are arranged over the dimmer controls so that the lighting effect may be observed by the operator.

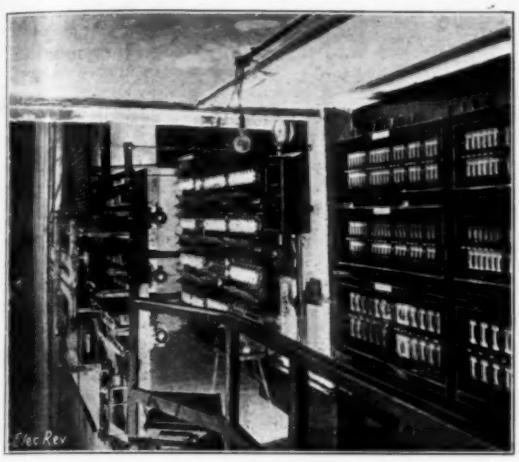


Fig. 5.—Operating Switchboard.

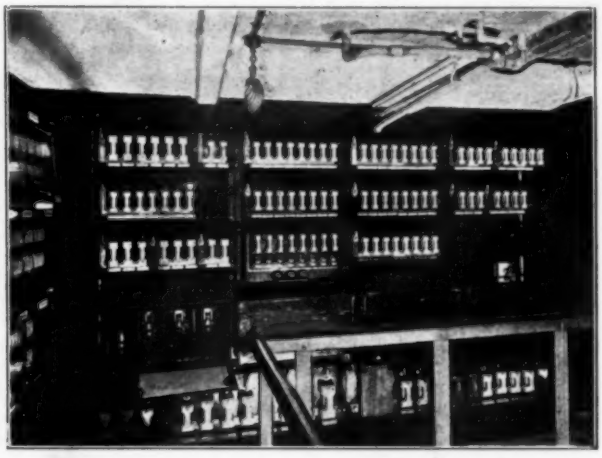


Fig. 6.—Positive Switchboard.

It may be of interest to record that over 25 miles of wire was used on the stage installation.

The whole of the reconstruction work was carried out without a single interruption in the usual programme of three performances daily and morning rehearsals, and the final change-over to the new 200-V system was made without a hitch of any kind.

The whole of the electrical work in both the auditorium and the stage installations was carried out to the plans and specifications of the consulting engineer, Mr. H. D. Wilkinson, M.I.E.E., to whom we are indebted for permission to view the apparatus, and much of the detail work in connection with the stage installation was developed by Mr. Wilkinson's colleague, Mr. P. S. Tasker. The contractors for the auditorium scheme were Messrs. Duncan Watson & Co., Ltd., and for the stage work Messrs. Tyler & Freeman.

Agricultural Electrical Machinery.

A comparative review of the exhibits at the 1927 Paris Agricultural Exhibition with those of previous years, and machines employed in other countries, depicting some items of special interest to engineers at home.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

(*Concluded from page* 333.)

There was one rather complicated-looking portable agricultural motor, the "Record." Incorporated with this machine is a pump, a circular saw (with a sliding table), and a train of gears with four projecting spindles which provide successively lower speeds for any pulley that may be placed on any one of them. A special winch pulley is provided for the last spindle, so that a rope may be wound round it for haulage purposes, like a crab winch. Altogether this equipment gives a choice of speeds of 50, 75, 100, 150, 200, 400, 600, and 800 r.p.m.

An improvement in the construction of the lighter portable motors is the provision of both stretcher handles and two wheels. The framing is usually so arranged that when it is set down upon its four supporting feet the wheels are just off the ground, which naturally improves the stability of the machine. French manufacturers do not yet seem to have grasped the importance of advocating drip-proof or protected motors for farm use, as is the general practice in Germany and Scandinavia. A tough-rubber-sheathed cable was employed generally for the portable motors. In one case, that of the Thomson-Houston Co., the cable was protected with a leather covering.

Most of the portable motors were provided with cable reels; from these the motors are temporarily disconnected while the cable is paid out to the required length. A plug on a short lead connected to the motor is then placed into a receptacle on the side of the cable drum to which the inner end of the cable is connected. Three-pin plugs are generally employed, with a central earthing pin.

For some time it has been the practice to fix the motor starters directly on to the motors intended for agricultural use. A detail improvement that was noticed was that the starters for the larger "Law" machines were built with curved casings, so that they might be fitted in any position on the cylindrical carcase of the motor. Several firms are now manufacturing a portable platform on which any standard electric motor can be fixed. This is fitted with barrow wheels and also tubular stretcher handles. Above or alongside the motor a shaft fitted with five pulleys of different diameters is mounted (on a pair of A frames, in the case of overhead pulleys).

Legendre Frères showed a portable motor without a chassis, fitted with two convenient carrying handles and a worm reduction gear. The spindle of the worm

wheel was connected to a flexible shaft, the latter being directly attached to the machine to be driven.

While French manufacturers are at present concentrating on the portable wheel-barrow type of farm motor, it should be borne in mind that Germany and Scandinavia have passed through this phase. Nowadays, in those regions, it is becoming the common practice to employ a large number of individual motors. This means more capital invested in motors, but less

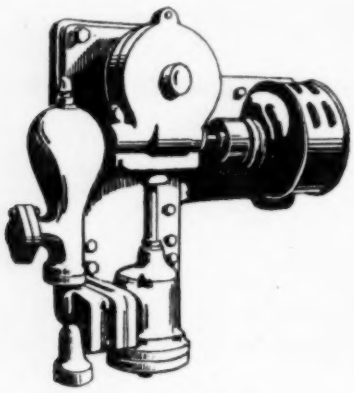


Fig. 9.—Electric Deep-Well Pump.

time wasted in adjusting portable machines and, after all, it is in the total cost per annum that the farmer is interested.

A very compact ball-bearing "Dupuis" threshing machine, which only requires a 3-h.p. electric motor to drive it, was on view. Generally, there were not so many electrically driven threshing machines shown this year.

Several milking machines were exhibited, though there was nothing new, except the "Delort" portable electric vacuum pump, which was mounted under a cover on a truck. One of the "Hinman" portable electric vacuum pumps was also shown. This is new to Europe, though it has been used in America for some time. Both these pumps appeal to the tenant farmer, for they avoid the erecting of permanent piping and shafting in the cow byres.

Most of the electrically driven cream separators were operated by a round belt drive, kept at the correct tension by a jockey pulley. However, the "Persoons" electrically driven separator had the motor directly connected. The machine was also arranged to drive a churn by means of an extensible tubular shaft. In the case of the "Melotte" directly driven electrical separator, a pulley was also fitted to drive a churn by means of a flat belt. Undoubtedly the directly connected electric drive will eventually become the standard, as it is difficult to keep the machines so clean when they have exposed belt drives, apart from the slight danger to the fingers in the use of such a drive.

Saw benches with bascule or tilting tables are still very popular. They are certainly most convenient, for logs can be sawn very much more easily and safely in a swinging V-shaped holder than on a table; yet for other work a table is imperative.

Two windmill electric generators were displayed, but there was no special novelty in their construction. The interest lay rather in the fact that evidently Frenchmen are toying with this method of "getting current for nothing."

A large range of electrically operated water pumps was shown. The high-pressure form is apparently rapidly coming into favour. A number of interesting types of deep-well pumps were on view, in particular the "Japy," a very neat design, fig. 9. The great majority of these pumps only employ fractional horse-power motors, as they depend upon the volume pumped by working steadily nearly all through the twenty-four hours of the day.

The Société Générale Agricole showed a very neat mercury-cum-weight gravity-control mechanism for stopping and starting a pump motor according to the water level. The same firm also exhibited an ingenious wood-turning lathe. This consisted of a standard breast drill arranged for clamping on a turned rod, the latter serving as the lathe bed. Several ingenious attachments result in its becoming an almost universal lathe, a circular saw bench, or various drilling devices.

The French farmer's wife is a confirmed user of washing machines. These are of a very simple character, consisting of a perforated galvanised drum, which is revolved, first one way and then the other, in a bath, fitted with a cover, fig. 10. The bath is usually heated with a charcoal, wood, or coke fire. Several new electric drives were on view this year. The difficulty to be overcome is that a considerable reduction in speed is required, coupled with a reversal of the washing drum, every few revolutions. The price of a complete electrically driven machine, without a wringer, but including the stove, is about £20. These machines are of much rougher finish than the American type that is usual on the British market; however, the first cost is very much less—about one-half.

In conclusion, it may be remarked that the exhibition gave an indication of a considerable advance in general agricultural machinery and also in the electric driving of the same. Undoubtedly attention will soon

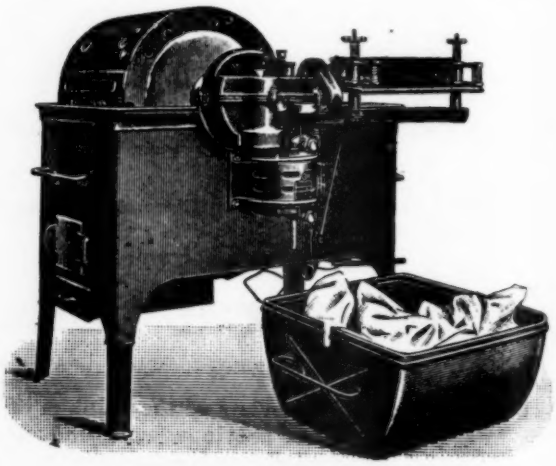


Fig. 10.—A French Electric Washer.

be paid to the design of farm machinery so that it will operate at a few selected speeds (as has already been done in Germany) that best suit motor driving and reduce the number of speed reductions required. The exhibition as a whole was certainly of a most interesting character.

Electro-Farming.

The paper on this subject which was read by Mr. R. Borlase Matthews before the I.E.E. in London last year has since been given at 11 Centres and Sub-Centres, with stereoscopic lantern slides and kinematograph films. On each occasion the contents were brought up to date. At Cardiff, on February 22nd, the paper was discussed at a joint meeting of the Western Centre and the South Wales Institute of Engineers; in the discussion Sir Iltydd Thomas stated that a considerable number of Welsh farmers near Cardiff were taking a supply of electricity from the South Wales Power Co. At Swansea, on the following day, when the lecture was repeated, Mr. C. T. Allan described his successful experiments with electro-culture at Llantwit Fadre, and Mr. Percy Player, who stated that he had used electricity on his farm near Swansea for 20 years, emphasised the necessity of adopting electric ploughing.

Sag Calculations for Power Transmission Lines.

A consideration of the requirements for Overhead Conductors under varying working conditions due to changes in temperature, wind pressure, ice covering, &c.

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E.

(*Concluded from page* 336.)

For the determination of sags and tensions under the different temperature and loading conditions, L_0 and L_t are the desired lengths required. The desired sag values D_1 and D_t are given in Table V. These values have been "rounded off" to the first decimal point, and are well within practical accuracy—more so than the possible inaccuracies of *constants* often used, and those inaccuracies made by the man in overalls (the lineman).

Example.—Suppose a 0.10 sq. in. (0.357 in. diam.) bare hard-drawn solid copper conductor is to be erected on a 400-ft. span in such a way that the tension (when loaded to the British Electricity Commissioners' specified loading) shall not exceed 26,550 lb./sq. in. at +22 deg. F., and let it be desired to find the sag and tension for:—

(1) Conductor at +22 deg. F. with ice and wind, as specified by the E.C.;
(2) conductor at 0 deg. F. with ice and wind, as specified by the E.C.;
(3) conductor in still air at 60 deg. F.;
(4) conductor in still air at 100 deg. F.;
(5) conductor in still air at 120 deg. F.

Constants.—$A = 0.10$ sq. in., $D = 0.357$ in., $d = 0.5$ in., $w = 0.386$ lb., $w_{11} = 0.917$ lb., $w_{111} = 0.905$ lb., $W = 1.288$ lb., $E = 18{,}000{,}000$ lb./sq. in., $\alpha = 0.0000093$ per deg. F., $P = 2{,}655$ lb., $l = 400$ ft.

Then, in terms of the allowable tension P, the sag for conductor at datum deg. F. with half an inch radial ice coating and 8 lb. wind at right angles to the line, from the general equation, is—

$$D = 400^2 \times 1{\cdot}288 \;\; 8 \times 2{,}655 = 9{\cdot}7 \text{ ft.} \qquad (\textit{see Table II})$$

and the length of conductor under this condition is—

$$L = 400 + 8 \times 9{\cdot}7^2 / 3 \times 400 = 400{\cdot}63 \text{ ft.} \qquad (\textit{see Table III})$$

but the length when all tension has been removed is—

$$L_0 = 400{\cdot}63 \;\; (1 + 2{,}655 / {\cdot}10 \times 18{,}000{,}000) = 400{\cdot}04 \text{ ft.} \qquad (\textit{see Table IV})$$

and, under this condition, for a rise in temperature of 100° F., the length of conductor in the span is—

$$L = 400{\cdot}04 \; (1 + {\cdot}0000093 \times 100) = 400{\cdot}42 \text{ ft.}$$

Hence, by simplifying and transposing the lengths, for the bare conductor in still air, we have—

$$3 \times 400{\cdot}42 \times 400^3 \times {\cdot}386 \;\; 64 \times {\cdot}10 \times 18{,}000{,}000 = 257{\cdot}6,$$

and

$$D_t^3 - \tfrac{3}{8} \times 400 \; (400{\cdot}42 - 400) \; D_t = D_t^3 - 63 \; D_t$$

or

$$(D_t^3 - 63 \, D_t) - 257{\cdot}6 = 0$$

$$D_t = 9{\cdot}46 \text{ ft.} \qquad (\textit{see Table V})$$

and the corresponding tension is—

$$P_t = 400^2 \times {\cdot}386 / 8 \times 9{\cdot}46 = 814 \text{ lb.}$$

For the different temperature and loading conditions we have the following data:—

Loaded, at 22° F.		—	Temperature without ice and wind loads.			
			0° F.	60° F.	100° F.	120° F.
L_1	400·12	L_t	400·04	400·27	400·42	400·49
$\frac{3 l^3 W L_1}{64 AE}$	859	$\frac{3 l^3 w L_t}{64 AE}$	257·36	257·5	257·6	257·65
$D_1^3 - \frac{3}{8} l (L_1 - l) D_1$	$D_1^3 - 18{\cdot}3 \, D_1$	$D_t^3 - \frac{3}{8} l (L_t - l) D_t$	$D_t^3 - 6 \, D_t$	$D_t^3 - 40{\cdot}5 \, D_t$	$D_t^3 - 63 \, D_t$	$D_t^3 - 73{\cdot}5 \, D_t$
D_1	10·15	D_t	6·7	8·41	9·46	9·94
P_1	2,538	P_t	1,150	907	814	776

That is—	(*Tension in lb.*) P	(*Sag in Feet.*) D_r	D_v
At zero °F. with ice and wind loads	2,655	9·7	6·9
At 22° F. with ice and wind loads	2 538	10·15	7·2
At zero °F. without ice and wind loads	1,150	—	6·7
At 60° F. without ice and wind loads	907	—	8·41
At 100° F. without ice and wind loads	814	—	9·46
At 120° F. without ice and wind loads	776	—	9·94

(D_r = plane of resultant; D_v = vertical plane); *see column 11, Table I.*

NOTE:—We thus see that, for this example, the maximum effective (*vertical*) sag occurs at the highest temperature.

TABLE V.—Sag Span Values at different Temperatures and Loadings for Hard-drawn Solid Copper Conductors.

Calculated from the parabolic equation— $[D^3 - \frac{3}{8} l (L_1 - l) D] - 3 L_1 l^2 w / 64 AE = 0$ *for 22° F.*

and $[D^3 - \frac{3}{8} l (L_t - l) D] - 3 L_t w / 64 AE = 0$ *for other temperatures.*

A.	t°	Span in Feet = l.									
		100	200	300	400	500	600	700	800	900	1,000
.01453	22	2·56	9·80	21·9	38·8	60·6	87·2	118·7	154·9	195·9	242·0
	40	1·17	8·47	21·0	38·7	59·2	85·8	117·3	153·9	194·4	240·4
	60	1·36	8·67	21·2	38·9	59·4	86·0	117·5	15 ·0	194·6	2 0·9
	100	1·75	9·07	28·6	39·3	59·2	86·4	117·9	154·1	195·(	241·2
	120	1·95	9·27	21·8	39·5	60·0	86·6	118·1	154·2	195·)	241·4
.01619	22	2·24	8·47	18·8	33·2	51·8	74·4	100·0	131·9	167·1	219·6
	40	0·73	7·00	17·0	32·8	50·2	73·0	98·7	13·5	166·4	218·2
	60	0·95	7·19	17·2	33·0	50·4	73·2	98·8	130·7	166·5	2 8·4
	100	1·38	7·58	17·6	33·4	50·8	73·5	99·1	131·0	166·9	218·7
	120	1·61	7·78	17·8	33·6	5 ·0	73·7	99·3	131·2	167·0	218·8
.01815	22	2·11	8·13	18·2	32·3	50·4	74·8	98·2	128·7	163·0	201·0
	40	0·51	6·74	16·8	30·8	49·0	71·2	96·6	127·2	161·5	199·6
	60	0·77	6·94	17·1	31·0	49·2	71·5	96·8	127·3	161·7	199·8
	100	1·31	7·40	17·5	31·5	49·6	71·9	97·3	128·8	161·1	200·2
	120	1·57	7·62	17·7	31·7	49·9	72·1	97·5	128·0	162·3	200·4
.02061	22	1·91	7·39	16·5	29·2	45·5	65·4	88·9	116·2	146·8	181·3
	40	0·50	5·82	14·9	27·5	4 ·8	63·8	87·4	114·6	145·3	179·7
	60	0·70	6·05	15·1	27·7	44·1	64·0	87·6	114·9	145·6	179·7
	100	1·11	6·51	15·6	27·8	44·5	64·5	88·1	115·4	146·1	180·4
	120	1·31	6·74	15·8	28·4	44·8	64·7	88·3	115·6	146·3	180·7
.02164	22	1·85	7·11	15·9	28·1	43·8	62·9	86·2	111·9	141·5	174·5
	40	0·48	5·47	14·2	26·4	42·2	61·5	84·7	110·5	140·1	173·2
	60	0·67	5·72	14·4	26·7	42·4	61·7	84·9	110·7	140·3	173·4
	100	1·07	6·20	14·9	27·1	42·9	62·1	85·3	111·1	140·7	173·7
	120	1·26	6·43	15·2	27·4	43·1	62·3	85·5	111·2	140·9	173·0
.025	22	1·65	6·36	14·1	24·9	39·0	56·1	74·8	99·7	124·6	155·4
	40	0·38	4·56	12·4	23·2	37·3	54·5	73·2	98·1	123·0	153·8
	60	0·55	4·88	12·7	23·5	37·4	54·7	73·4	98·3	123·2	154·0
	100	0·90	5·51	13·3	24·1	37·7	55·2	73·8	98·7	123·6	154·4
	120	1·08	5·83	13·6	24·4	37·8	55·4	74·1	98·9	123·8	154·6
.02688	22	1·57	6·04	13·4	23·6	36·9	53·0	72·0	94·0	120·2	146·7
	40	0·35	4·19	11·6	21·8	35·1	51·3	70·3	92·3	118·4	145·0
	60	0·51	4·48	11·8	22·1	35·3	51·6	70·5	92·5	118·6	145·2
	100	0·81	5·05	12·4	22·6	35·8	52·6	71·0	93·0	119·1	145·6
	120	1·01	5·31	12·7	22·9	36·1	5 ·3	71·2	93·2	119·3	145·9
.02926	22	1·16	5·77	12·6	22·6	35·2	49·8	67·6	86·5	111·5	137·7
	40	0·32	3·67	10·6	20·2	3 ·7	47·9	65·8	84·6	109·7	135·9
	60	0·49	4·01	10·9	20·5	33·0	48·2	66·1	84·9	1 0·0	136·7
	100	0·83	4·68	11·5	21·2	33·5	48·4	66·6	85·5	110·5	136·2
	120	0·99	5·02	11·9	21·5	33·8	49·0	66·9	85·7	110·8	136·3
.03269	22	1·35	5·20	11·6	20·5	32·5	46·6	62·2	81·0	102·6	126·5
	40	0·30	3·12	9·7	18·8	30·5	44·9	60·4	79·2	102·7	124·6
	60	0·46	3·46	10·0	19·1	30·8	45·2	60·7	79·5	100·9	125·8
	100	0·69	4·14	10·6	19·7	31·3	45·7	61·2	80·0	101·5	125·3
	120	0·85	4·48	11·0	20·0	31·6	46·0	61·5	80·3	101·7	125·6
.03631	22	1·18	4·86	10·5	18·4	28·6	41·1	55·7	72·5	91·2	115·0
	40	0·28	2·62	7·8	16·2	26·4	39·0	53·6	70·4	89·1	112·9
	60	0·40	2·99	8·3	16·6	26·8	39·3	54·0	70·7	89·4	113·2
	100	0·64	3·72	9·2	17·3	27·4	39·9	54·6	71·4	90·1	113·9
	120	0·76	4·09	9·7	17·6	27·8	40·3	54·9	71·7	90·4	114·2
.05	22	0·96	3·90	8·6	15·1	23·5	34·5	46·0	59·7	75·4	91·7
	40	0·26	1·84	6·5	12·9	21·2	31·4	43·1	57·0	73·0	89·3
	60	0·37	2·21	6·8	13·3	21·5	31·7	43·4	57·3	73·3	89·6
	100	0·58	2·92	7·6	14·0	2 ·3	32·4	44·0	57·9	73·6	90·1
	120	0·69	3·31	7·9	14·3	22·6	32·7	44·3	58·5	73·9	90·3
.075	22	0·79	3·06	7·1	11·8	18·3	26·1	35·4	46·1	58·3	71·8
	40	0·26	1·31	4·8	9·7	16·0	23·7	33·1	43·7	55·8	69·3
	60	0·37	1·67	5·2	10·1	16·4	24·2	33·7	44·2	56·3	69·7
	100	0·58	2·39	5·9	10·9	17·4	25·1	34·8	45·1	57·3	70·8
	120	0·69	2·75	6·3	11·3	17·6	25·6	34·9	45·6	57·8	71·2
.10	22	0·68	2·68	5·8	10·2	15·6	22·3	30·2	39·4	49·7	61·6
	40	0·26	1·30	4·2	8·3	13·5	20·0	27·8	36·8	47·0	58·7
	60	0·37	1·66	4·6	8·5	13·9	20·4	28·3	37·1	47·5	59·4
	100	0·58	2·38	5·3	9·5	14·7	21·2	29·2	38·7	48·8	60·8
	120	0·69	2·74	5·6	9·9	15·1	21·6	29·7	39·0	49·4	61·5
.125	22	0·61	2·35	5·2	9·07	14·1	20·0	27·1	35·6	44·6	54·9
	40	0·. 6	1·16	3·6	7·09	11·6	17·0	24·3	3 ·9	42·0	52·4
	60	0·37	1·50	4·0	7·54	12·1	17·7	24·9	33·5	42·7	53·1
	100	0·58	2·18	4·8	8·45	13·2	18·9	26·2	34·8	43·8	54·4
	120	0·69	2·53	5·2	8·90	13·7	19·6	26·8	35·4	44·5	55·0
.15	22	0·57	2·19	4·8	8·5	13·1	18·6	25·2	32·7	41·1	50·8
	40	0·28	1·16	3·5	6·9	11·2	16·4	22·8	30·1	38·3	47·5
	60	0·40	1·50	3·9	7·3	11·7	16·8	23·4	30·8	39·2	48·6
	100	0·64	2·18	4·7	8·2	12·8	18·6	24·8	32·3	41·1	50·3
	120	0·76	2·52	5·1	8·7	13·3	19·0	25·5	33·0	42·0	51·1
.175	22	0·52	2·12	4·6	8·1	12·5	17·7	24·0	3 ·6	39·3	48·4
	40	0· 9	1·30	3·6	6·7	10·7	15·7	22·0	29·6	37·3	45·4
	60	0·41	1·61	3·9	7·1	11·3	16·4	22·7	30·1	38·0	46·3
	100	0·59	2·22	4·6	8·0	12·3	17·7	23·9	31·8	39·2	48·1
	120	0·77	2·53	5·0	8·4	12·9	18·3	24·6	32·2	39·9	49·0

Improved Electric Tramcars.

Two new cars built for experimental service on the North London system of the Metropolitan Electric Tramways, Ltd., their features being light weight, high acceleration, smooth running and comfort.

FOR some considerable time close attention has been devoted by the tramway companies associated with the London "Underground" group to the improvement of car design. On the system of the London United Tramways, Ltd., 70 cars have been equipped with modern light-weight motors having specially designed characteristics for rapid acceleration, and 110 cars with improved brakes; 45 cars of the Metropolitan Electric Tramways, Ltd., are now being fitted with new motors, which are an advance on even those of the L.U.T., Ltd. In addition, a number of cars have been fitted with specially well sprung moquette-covered transverse seats, and the interiors of the cars have been repainted and provided with white ceilings, which, together with improved lighting, has added to the attractiveness of the service afforded.

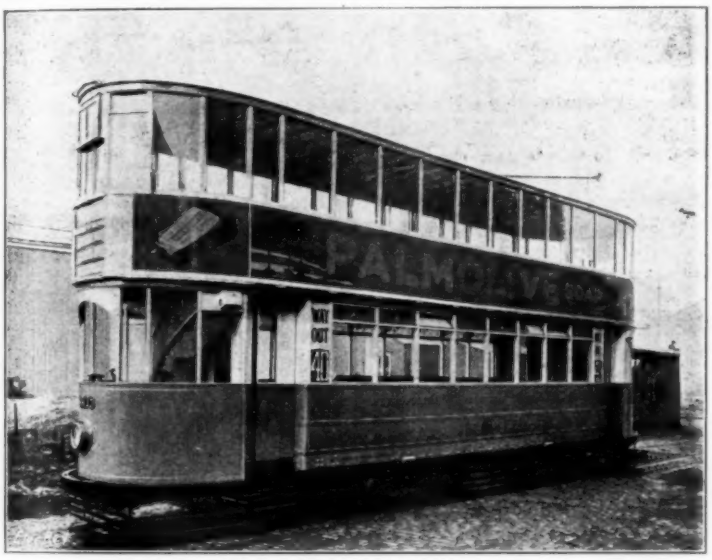


Fig. 1.—New M.E.T. Electric Tramcar.

It is interesting to note that this example has been followed by other London and provincial undertakings, whilst a questionnaire, by means of leaflets in the cars asking for opinions or suggestions, resulted in many thousands of replies being received, indicating public approval and appreciation.

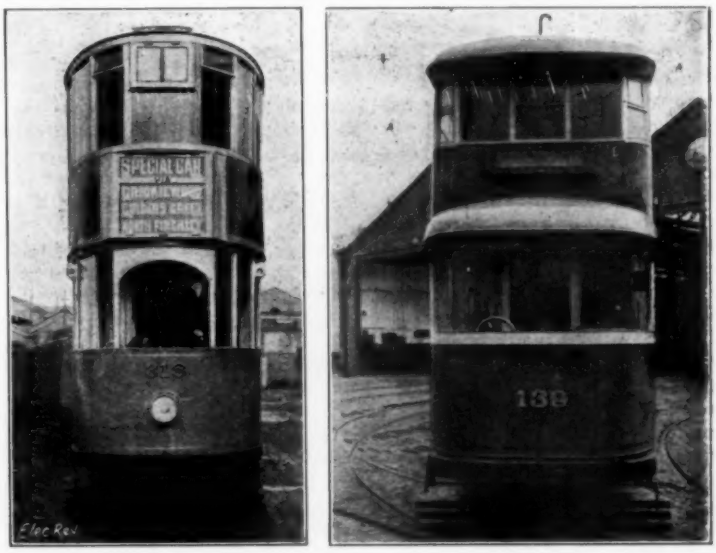
To obtain full advantage of further improvements, the M.E.T., Ltd., has designed and built at its Hendon works a new car known as "The Bluebell," and to exclude any influence of conventions of existing tramcar design, the interesting step was taken of asking the London General Omnibus Co. to design and build a tramcar body at its Chiswick works. The design was based on comfort, even at the expense of reducing the carrying capacity, and the experience gained with the new cars should be of considerable value.

The M.E.T. "Bluebell."

This car's leading features, in comparison with the existing standard type of double-deck top-covered car, with cross seating, are set out in Table I.

The body is of light-weight construction, composed chiefly of steel channel filled with wood (ash); the platforms used by passengers are level with the main floor of the car, only the driver's compartment being at a lower level, and there are only two steps between the ground and the body floor (the same number as on N.S.-type omnibuses). The staircases have been designed to allow of passengers alighting at the front end whilst others are boarding at the rear end, thus avoiding obstruction. The interior is as free as possible from all mouldings or corners liable to collect dirt, and stainless steel is used for all hand railing and hand-grip stanchions. In the top saloon, each window opens by vertical slide of the balanced type operated individually by passengers.

Transverse moquette-covered seats are fited in the lower saloon with short longitudinal seats at each end in order to provide for standing passengers without obstruction, and a considerable area of platform is available for the same purpose. In the top saloon, transverse spring seats covered with a leather substitute are fitted; the flooring in the lower saloon is of grey rubber.



Built by M.E.T., Ltd. Built by L.G.O. Co.

Figs. 2 and 3.—Front Views of New Cars.

Table I.—The M.E.T. Car.

	New car.	Existing type.
Length over buffers ...	36 ft. 4 in.	34 ft. 8 in.
Maximum width ...	7 ft.	7 ft.
Width inside lower saloon	6 ft. 4 in.	6 ft. 0½ in.
Height, lower saloon ...	6 ft. 3 in.	6 ft. 0½ in.
Height overall from rail	15 ft. 2 in.	15 ft. 5¾ in.
Height of car floor from rail	2 ft. 5 in.	2 ft. 9½ in.
Weight of body with equipment	6 tons	10 tons 11 cwt.
Total weight unloaded ...	12 tons 5 cwt.	16 tons 11 cwt.
Seating capacity, lower saloon	27	27
Seating capacity, upper saloon	44	46
Total carrying capacity, including standing ...	105	85

The driver stands in an enclosed partition with semi-vestibule front, mirrors being situated so as to give him a clear view of the front and rear doorways.

The electrical control is on the contactor system with master controllers and interlocks, of the B.T.-H. Co.'s make, the contactor gear being situated in a convenient compartment on the platform. Air brakes acting on the track and wheels, with emergency cocks at each end of the car for use by conductor or passengers in case of need, act in conjunction with air-blast sanders, and hand brakes are also fitted, operated by a wheel in the motorman's cabin.

Fig. 4.—Upper Deck, M.E.T. Car.

The trucks are of the low-wheel bogie type, the driving wheels being 28 in. in diameter instead of the usual 31¾ in. All axle boxes are equipped with roller bearings and the motor armature shafts with ball and roller bearings. The motors are of light weight, rated at 50 h.p. each, two motors being fitted; they weigh 35 lb. per rated h.p., compared with 56 lb. for the older motors, and they give smooth and rapid acceleration, taking full advantage of their large overload capacity.

Folding doors and steps working in unison at each entrance are operated by the motorman manually through a system of ball-bearing rods and levers. Special attention has been given to lighting, which is carried out by means of opal-glass bulbs in suitable fittings. The lighting switches and fuses are enclosed in a small cupboard, and headlights are fitted with special reflectors designed to be effective in foggy weather.

The L.G.O.C. Car.

The car built by the London General Omnibus Co. was at attempt to evolve a tramcar on modern omnibus practice. In many respects it is similar to the vehicle described above, so that only those features wherein it differs will be mentioned. Some of its main dimensions are shown in Table II. The electrical controller is of the camshaft type acting in combination with a line switch, of the Metropolitan-Vickers make. Brakes, sanders, trucks, and motors (though of different make) are identical.

Table II.—The L.G.O.C. Car.

Length over buffers	36 ft. 0 in.
Width, lower deck	6 ft. 9 in.
Height	14 ft. 10 in.
Width of main door openings	3 ft. 10 in.
Width of emergency door openings	1 ft. 6½ in.
Number of seats, lower deck	28
Number of seats, upper deck	36
Total weight, unladen ...	12 tons

All vertical pillars are ash, with steel flitches of 14 S.W.G. inserted, gusseted to the main chassis frame, which is a Z section pressing of nickel steel. The body in its entirety is carried upon this chassis frame.

The motorman's compartment is totally separated from the main lower saloon by a sliding door, but not enclosed. The controls are within easy reach, and include a Peters air brake valve and a Peacock emergency hand-brake lever.

Fig. 5.—Upper Deck, L.G.O.C. Car.

Double sliding windows are fitted in the upper saloon, provision having been made for excluding draughts when travelling in either direction. A light aluminium metal domed roof is incorporated, reinforced with a steel structure in the centre for carrying the trolley pole collector; trap doors and a "cat walk" are also fitted.

Semi-bucket seats are arranged transversely and longitudinally, the seats and backs being spring filled and upholstered in moquette.

For interior lighting small white opaque bulbs are employed in conjunction with white reflectors. The interior paint is white enamel, and electric bell pushes are fitted at regular intervals.

Two double folding doors form the main entrances, with two small doorways at the other corners for use in emergency, the normal operation being to board and alight at the rear end as in the case of ordinary cars. Steps of a very ingenious design, operated by a removable lever, have been devised to serve two purposes: not only does the step tread rise into a vertical position when folded so as to prevent "hangers on" when the door is closed, but the vertical riser of the steps moves to a horizontal position in order to close the open floor space (when the door is closed) and serves as a portion of the platform.

London Transport.

Report of the London and Home Counties Traffic Advisory Committee.

LAST week the report of the Advisory Committee on the inquiry held in October, 1926, with respect to the travelling facilities to and from South-East London, was issued (H.M. Stationery Office, price 1s. net).

The area concerned comprises seven Metropolitan boroughs, covering 27,934 acres, with a population of 1,098,621 in 1921, when 250,000 persons had to travel into or out of the area every day. A map is included, showing the railways and tramway and omnibus routes in the area; all but one of the railway lines are now electric, there being 140 miles of surface electric railway in the area, and 48 stations. Only 1¼ miles of underground "Tube" electric railway is included in the seven boroughs. The L.C.C. electric tramways operate along 46½ miles of street, and 1,492 omnibuses are in service.

During the war nine railway stations were permanently closed, and owing to the competition of tramways and omnibuses the company held that there was little demand for railway facilities within about four miles of Charing Cross. Complaints of overcrowding at rush hours were made, with especial reference to London Bridge station. The local authorities urged the need for new tube railways in the area.

The Committee concludes that main-line trains should not stop at stations within three miles of their termini, except at junctions. The congestion at rush hours has increased since the war owing to changed conditions of employment, resulting in the majority of workers starting and stopping work at about the same time. The electrification of the suburban lines has helped, and will further help, to relieve the situation, and the action of the Southern Railway Company is warmly commended; the consideration of additional underground railways should be deferred until the Company's plans are completed, but the extension of the Bakerloo line in a south-easterly direction is worthy of examination. Fares should be regulated by co-operative action in such a way as to attract long-distance passengers to the railways. Owing to the existing congestion in the northern part of the area, no addition should be made to the numbers of tramcars and omnibuses operating there. The question of linking the East London Railway with the Southern Railway, to enable through trains to be run between the Metropolitan and Southern Railways, should be immediately considered; this would necessitate the provision of a fly-over junction between Whitechapel Junction and Aldgate, recommended in the Committee's report on travelling facilities to and from East London, which would effect a great improvement.

Finally, the Committee again emphasises the necessity for bringing all forms of public passenger transport in London under unified control; inquiries with this end in view are being made by a sub-committee.

The report is accompanied by a number of appendices giving statistics, fares, &c.

The Brazilian Market.

Commercial Secretary's Report.

A report upon the economic and financial conditions in Brazil (dated October, 1926) has been forwarded to the Department of Overseas Trade by Mr. E. Hambloch, Commercial Secretary at Rio de Janeiro (Stationery Office, 1s. 6d. net). In the course of a general survey, Mr. Hambloch says that guerilla warfare, restriction of capital, a sudden rise in the exchange, and a number of other causes combined to make the year ended September last an uneasy one for commercial circles. The position is, however, not viewed pessimistically, for Brazil has great recuperative powers and its purchasing power continues to increase. The latter would expand more rapidly if transport facilities were improved. There is probably no country in the world with such vast potential wealth, but for the full development of the country's resources by private enterprise, the moral and sympathetic support of the authorities and more settled policy are necessary. Foreign capital is required, and any impression that it is not welcome should be dispelled.

Competition in Electrical Supplies.

The United States retained its place as the premier exporter to Brazil during 1925, and the margin between its share of the trade and that of Great Britain widened, although both countries' totals increased. Germany was again third with an appreciably increased share. Taking the Dominions into account, the British Empire, as a whole, was the leading supplier. While actual detailed figures for 1925 were not available, Mr. Hambloch says that it is believed that the exportation of American material to Brazil increased. British manufacturers have to face severe competition in the cases of electrical copper wires and cables, electrical apparatus, dynamos, motors and transformers. German exporters are also very active in the same directions, while Belgian competition is mainly felt in the case of cables. The Americans have large stocks of a very wide range of electrical articles in the principal centres.

Electrical Developments.

During the period under review, a number of small local hydro-electric installations were made, but the only new one worthy of note is that at Cubatao (between Santos and Sao Paulo), which was inaugurated in October last by the Sao Paulo Tramway, Light and Power Co., Ltd. The initial plant consists of two 40,000-h.p. sets; the station is designed for 80,000-kW ultimate capacity. This installation brings the aggregate developed hydro-electric power in the state of Sao Paulo to 250,000 h.p.; Rio de Janeiro has 165,000 h.p., Minas Geraes 52,000 h.p., and Bahia 20,000 h.p. The total development in Brazil is estimated at 500,000 h.p. out of a total available of 9,000,000 h.p.

In March, 1926, a British company obtained the contract for the electrification of 73 km. of the Oeste de Minas Railway. The work is in progress, and this is the first length of railway line to be electrified under the administration of the Federal Government. Nothing has been done in connection with the projected electrification of the Central Railway.

With regard to radio-telegraphy, in April, 1926, the Cia. Radiotelegraphica Brasileira (working under Marconi patents) inaugurated a high-power station at Sepetiba (near Rio de Janeiro), with 12 steel towers, 250 m. in height. There is a receiving station at Jacarépagua (near Rio).

Up to December, 1924, licences had been granted for 2,469 broadcasting receiving sets, and in 1925 a further 1,070 licences were issued, making 3,539. The annual charge for licences is 20 milreis (about 12s.).

Rubber.

In 1925 the exportation of rubber increased, and prices reached a higher level than has been attained for many years. The total in 1925 was 23,537 tons, and the average value was £214 18s. a ton; in the preceding year, while the exportation was not far behind (21,568 tons), the value per ton was only £91. The Ministry of Agriculture has declared that the organisation and systematisation of the exploitation of Brazilian rubber are necessary, but no guidance has been given as to the methods to be adopted.

Legal.

Swedish General Electric, Ltd.'s Patent Application.

THE Swedish General Electric, Ltd., holders of a patent granted to H. K. Schrager for "improvements in alternating current commutator motors," applied to Mr. Justice Tomlin in the Chancery Division on March 1st for an extension of the patent on the ground that by reason of the war they had suffered loss or damage.

Mr. Stafford Cripps supported the application, which was opposed by Mr. Trevor Watson on behalf of the General Electric Co., Ltd., and Mr. McEwan on behalf of Witton-James, Ltd.

Mr. CRIPPS said the patent dealt with an expensive and very novel machine, and, roughly, the reason given for the application was that it could not be marketed during the war in this country because, the machine having no war uses, nobody could take it up, and it was not until after the war that proper attention could be devoted to it. It was a motor that did away with all gearing, and it was not the sort of machine that could be sold straight away. There was a special design for different kinds of installations. Four years was a comparatively short time to develop such an article, but had there been no war the advertising matter sent out would have developed a market here in 1915 or 1916.

Mr. TREVOR WATSON said no explanation had been given why no licence was granted to work the patent here until 1920, when one was granted to the British Thomson-Houston Co., Ltd. The applicants were not engaged on work of national importance during the war, and there was no evidence that they had suffered loss or damage. There was no established trade here in the motor before the war, and they had not reached the point, when war broke out, at which they might confidently have expected to build up a trade. In the words of the section of the Act there was no "loss of opportunity of dealing in or developing the invention," a contention which was only open to applicants who could show that they were engaged in work of national importance. Before 1914, instead of developing the English market, the applicants chose to develop the foreign market. They were content to do nothing during the war, and there was no reason to suppose that they suffered any loss except through their own fault. Everything went to show that if the applicants had made an effort in this country to establish the manufacture and sale of this motor in any way comparable to the effort they made in foreign countries, they would have had no reason to complain of loss or damage resulting from the war.

Mr. MCEWAN associated himself with this statement of the case for the opposition.

Affidavit evidence was read, and after Mr. Cripps had replied, his Lordship gave judgment.

He said the applicants did not do anything before the war to develop the patent in this country, although they developed it abroad, and he must come to the conclusion on the evidence that if the invention had not established itself in the market here before the war it would not be likely to establish itself here during the war. It was a machine of some complication, and could only be applied to existing installations with substantial alterations. It was expensive to make, and was not applicable directly to war purposes. In those circumstances the company's campaign to establish it during the war did not produce any results, and it was not until 1920 that the applicants took it up again, and then they granted a licence to the British Thomson-Houston Co. to manufacture it. The real point was whether, the company not having chosen to develop the patent here before the war, and being handicapped when they sought to do so during the war, there was loss or damage caused by the war. He was satisfied that the course which the applicants took resulted to their disadvantage, but his conclusion was that he ought not to regard that course of conduct as disabling them from seeking relief if they proved that they suffered because of the war. He therefore proposed to give one year's extension of the patent, to date from that day.

Indictment of Cory Bros., Ltd., Quashed.

AT Cardiff, on February 28th, Mr. Justice Finlay quashed the indictment against Messrs. Cory Bros., Ltd., upon an allegation of causing the death of a collier by setting a man-trap in the form of an electrically-charged fence. His Lordship held that a corporation could not be indicted for either felony or misdemeanour.

The case against three of the company's officials was, however, proceeded with. The defendants were Thomas Hardie, shift engineer, Temple Davies, power station engineer, and Robert Illingworth, electrical engineer. The evidence at the original proceedings was repeated. This was to the effect that to prevent the continuance of pilfering of coal supplies from the company's power house, a wire fence was erected and made "alive" during certain hours. The defendants were stated to be responsible for its erection and charging. Evidence was given by a man who was with John at the time of his death to the effect that they were not stealing, or endeavouring to steal, coal.

Sir BERNARD SPILSBURY (Home Office) said that John's death was due to heart failure caused by the passage of an electric current. The extent of the shock depended largely upon the conditions existing; he had known two cases of death from shocks at voltages of 65 and 46.

One of the defendants, R. ILLINGWORTH, said that it was only intended to give raiders a "tingle." He did not think that the fence was dangerous; he himself had touched it without feeling any effect.

The hearing was concluded on March 3rd, when after hearing further evidence by the defendants the jury returned a verdict of "Not guilty," and the accused were discharged.

H.M. Inspector of Factories v. Barr & Stroud, Ltd.

IN the Justiciary Appeal Court, Edinburgh, on March 1st, counsel were heard in an appeal by H.M. Inspector of Factories, Glasgow, against a decision of Sheriff-Substitute Dods finding a complaint against Barr & Stroud, Ltd., engineers, Glasgow, not proven. The complaint was that the respondents failed to keep a certain horizontal milling machine in their works securely fenced. No accident was known to have occurred at the particular machine involved.

The Court affirmed the original decision, and awarded the respondents 10 guineas expenses.

Infringement of Grid Leak Patent.

The Times reports that a fine of £20 and an order to pay 30 guineas costs were imposed at West London Police Court on March 1st on Alfred Sacks, wireless dealer, Fulham, who was summoned for selling grid leaks to which the false description of "Lissen" was applied.

Mr. H. D. ROOME, prosecuting for Lissen, Ltd., stated that they were the patentees of the "Lissen" grid leak. Lately they became aware of the fact that spurious grid leaks bearing their name were being sold at wireless shops. On four different occasions purchases were made at the defendant's shop of Lissen grid leaks, and these, on examination, were found to bear the name "Lissen grid leaks," but were, in fact, spurious, differing in certain important details from the genuine article.

The defendant stated that he purchased the grid leaks in good faith from a man at Brixton, and when he found they were not genuine "Lissen" grid leaks, he requested the man to take them away. Apparently the man must have left some behind, and these were innocently sold by an assistant

Dublin Workmen's Compensation Case.

IN the Dublin Circuit Court, before Judge Davitt, last week, Mrs. Mary Slowey, Dublin, claimed compensation from the Dublin City Commissioners in respect of the death of her husband, Michael Slowey.

Mr. W. J. GLEESON, B.L., for the applicant, said that the deceased man was employed on January 17th, 1921, in the electric lighting department of the Corporation of Dublin. While at work he came into contact with a "live" electric wire, and received a severe shock, from which he suffered certain injuries. He was a patient in hospital for some time, but was able to resume work. Later on he developed tubercular disease in the left wrist. The disease spread through his body and he died. The Commissioners had agreed to pay £100 to the applicant, in addition to her costs and expenses.

Judge Davitt made the award accordingly.

B.T.H. Patents in the Irish Free State.

IN the High Court, Dublin, before Mr. Justice Meredith, last week, in the case of the British Thomson-Houston Co., Ltd., *v.* Litton & Co., Ltd., Dublin, an application was made to discharge an order of the Master of the High Court, giving liberty to serve a third-party notice on Messrs. Grammont, a French manufacturing firm. The action was brought to restrain the defendants from, as alleged, infringing patents connected with electric lamps, and for damages.

Mr. JUSTICE MEREDITH, in giving judgment, referred to the grounds urged by the plaintiffs and Messrs. Grammont, on which he was asked to discharge the order, and held that the Master had jurisdiction to make the order *ex-parte*, that the contract to indemnify was a contract to be performed within the jurisdiction, and that the defendants *primâ facie* had claim to be indemnified, though the question whether the claim was sustainable or not was one which would have to be decided in the action. He refused the application to discharge the Master's order, and gave the costs of the plaintiff's motion against the plaintiffs, and reserved the costs of Messrs. Grammont's motion.

British Thomson-Houston Co., Ltd., v. Metropolitan-Vickers Electrical Co., Ltd.

THE hearing was commenced in the House of Lords on March 7th, before Lords Dunedin, Sumner, and Blanesburgh, of an appeal arising out of the alleged infringement by the appellants of the respondents' patent 9644 of 1912. Mr. Justice P. O. Lawrence found, after a long inquiry, that the letters patent had been infringed by the appellants, but that they were invalid. In the Court of Appeal, the Master of the Rolls and Lords Justices Warrington and Sargant reversed his decision as to validity, expressing the opinion that the patent was valid and had been infringed. It was against this judgment that the British Thomson-Houston Co. appealed to the House of Lords, contending that the judgment of Mr. Justice Lawrence upon the question of validity was right and should be restored. The respondents maintained that Mr. Justice Lawrence was in error upon the issue of validity, while the Judges in the Court of Appeal were right in fact and law.

The appellants, in their attack upon the validity of the patent, rely upon a prior specification of Tesla, United States, number 459,772, dated September, 1891. There appeared for the appellants Sir Arthur Colefax, K.C., Mr. W. Trevor Watson, K.C., and Mr. Bernard Sandeman, and for the respondents Sir Duncan Kerly, K.C., Mr. J. Whitehead, K.C., Mr. J. M. McEwen, and Mr. J. Mould. The patent in dispute is that granted in 1912 to Emanuel Rosenberg for an invention of improvements relating to synchronous dynamo-electric machines, and the appellants say that in view of Tesla's specification Rosenberg's is not novel.

The arguments extended to considerable length, and the hearing was adjourned.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Private Bills.

The Yorkshire Electric Power Bill has been read a second time, and the North Metropolitan Electric Power Supply Bill has been read a third time, in the House of Lords.

Radio for Aircraft.

On March 2nd Mr. DAY asked the Secretary of State for Air if the experiments that had taken place for short-wave radio-telephony between aircraft in flight and air stations had been successful; and whether that system of transmission would be shortly introduced into the air services.

Sir S. HOARE said that the system of transmission referred to was already in use in the Royal Air Force, and the possibilities of its extension were continually kept in view.

High-Power Broadcasting.

On March 1st, Lieut.-Commander KENWORTHY asked the Postmaster-General whether the British Broadcasting Corporation had decided on its policy with regard to the building of high-power stations in order to provide alternative programmes all over the country; if so, how far the work had progressed; whether he had been consulted as to that policy; and, if so, what had been the Government opinion expressed.

Sir W. MITCHELL-THOMSON said that the present position was that the British Broadcasting Corporation was arranging to carry out certain experiments, and when those were concluded it might be in a position to submit proposals.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Campaign Notes, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

The E.D.A.-E.L.M.A. Campaign.

The official report dated March 7th records the opening of demonstration houses at Glasgow (Minard Road), Chesterfield, Leicester and Birmingham. The following places are opening demonstration houses in the course of a week or two :— Peterborough, Ipswich, Bermondsey, Birmingham, Potteries District, Chorlton, Paisley, and Derby. Last week exhibitions were opened at Dumfries and Bingley. A former Lady Mayoress of Manchester (Mrs. Simon) was to open the Chorlton house on Tuesday last. The Prestwich house is being visited by 300 people a day; 899 visitors attended the Aberdeen house during the first nine days; and 5,144 people visited the Minard Road, Glasgow, house during the first five days. The house at Brent, organised by the Hendon Circle, recorded an attendance of 8,000. Good business is being reported from all quarters as a result of the demonstration houses. Contractors in Manchester and Stockport are distributing competition booklets among patients in the local hospitals.

On February 25th an all-electric home exhibition was opened at Bingley. It was conceived by the Electricity Department of the Urban District Council (engineer: Mr. P. Clegg) and loyally supported by the local contractors and their employés, who did all the necessary work voluntarily. Seven "rooms" were erected at the Drill Hall; these were furnished by local firms, and the remainder of the hall was loaned to manufacturers for display and demonstration purposes. The exhibition, which remains open until to-morrow (Saturday), has attracted a great deal of public interest; a number of orders have been received, and many inquiries have been made. We reproduce herewith a photograph of the display taken by a local photographer, Mr. G. Tillett.

The Bingley Electrical Exhibition.

The Sunderland Corporation Electricity Department has been lent a house by a local builder and has thoroughly equipped it with electrical appliances. A local company has furnished the dwelling in a tasteful manner. The house was opened to the public on March 1st, and is to remain open for a month. The exhibition has been well advertised in the local Press.

An all-electric house in the Crescent, North Road, Durham, arranged by the County of Durham Electrical Power Distribution Co., Ltd., was formally opened by the Mayor and Mayoress of Durham on Tuesday last week. Mr. W. F. T. Pinkney, of the company, received the guests, who were addressed by the Mayor on the advantages of electricity in the home. The house was open all the week and was visited by a large number of people.

Wages in the Engineering Industry.

We recently reported that the London District Joint Committee of the trade unions connected with the engineering industry had recommended a claim for an all-round increase of about 12s. per week in the wages of their members. The matter is now being considered by the Committee's constituents, and a meeting is to be held on March 14th, at which their opinions will be expressed. In the meantime notice has been given of a meeting at York on March 24th, at which the question of a national increase will be discussed by representatives of the engineering trade unions.

Unemployment.

The number of unemployed upon the books of the Employment Exchanges on February 21st was 1,196,100. This was 74,117 fewer than on February 14th, but 70,340 more than on February 22nd, 1926.

Electric Kitchen in a Shop.

In connection with a special household shopping week which they recently held, Messrs. George Henry Lee and Co., Ltd., of Liverpool, constructed in their premises a model electric kitchen, in which were given daily demonstrations of cooking by electricity. This kitchen was equipped with an H.810 "Xcel" electric cooker, manufactured by the Automatic Telephone Manufacturing Co., Ltd, whilst a comprehensive range of electric fires, irons, kettles, and other "Xcel" electric appliances was displayed. As may be seen from the illustration, the kitchen was very realistically arranged.

Electric Cooking in a Department Store.

The Timber Market.

Our Timber Trade Correspondent reports that timber consumption, on the whole, in the U.K. is not moving as quickly as anticipated in the early weeks of the year. Stocks of building, joinery, and general woods are ample at present rates of consumption, which shows an improvement compared with a year ago, but cannot be described as good. Spot prices are not up in proportion to shippers' ideas. The hardwoods also are not yet moving very quickly into consumption; good grade mahogany, however, is selling well, but cabinet and furniture manufacturers are only buying hardwoods from hand to mouth. This hold-off policy may not prove the right one if continued for too long, as the demand for timber, both for general purposes and furniture and other fancy work will grow with the progress in general trade, and prices, no doubt, will increase in sympathy.

Irish Free State Electrical Imports.

The returns just to hand show that the imports of electrical goods, excluding machinery, into the Irish Free State attained a value of £40,934 during January last, as compared with £52,407 in January, 1926.

New Zealand's Preference for British Goods.

The New Zealand Government, which has been placing heavy orders in Britain recently for electrical, railway, and other plant, is again in the market for six electric locomotives, large quantities of locomotive workshop machinery, and material for the electrification of the railway tunnel between the Port of Lyttelton and Christchurch. The New Zealand High Commissioner, Sir James Parr, has just received the details of these requirements, with the authority to obtain tenders from British manufacturers. In the aggregate the orders will run into a very considerable sum of money. The workshop material includes about 40 electric drills, welding plant, mechanical hammers, lathes, bull-dozers, four electric cranes, and many other machines. In addition to the above, the New Zealand Public Works Department, through the High Commissioner, is seeking to place orders for electrical equipment for a new sub-station at Lyttelton (from which the electrification of the Lyttelton tunnel will be operated). The same Department is also in the market for four 500-kVA transformers for the Waikaremoana (Hawke's Bay) power scheme, and four 15,000-kVA, seven 1,000-kVA, and eleven 750-kVA transformers for the Arapuni (Wellington) scheme. Manufacturers can obtain full particulars of all these requirements from the High Commissioner for New Zealand, 415, Strand, W.C.2.

Price Reductions.

Increased production and improved manufacture have enabled the London Electric Wire Co. & Smiths, Ltd., to reduce the price of its "Lewcos" screens and bases for inductance coils and radio transformers.

Industrial Electric Cooking Equipment.

The GENERAL ELECTRIC CO., LTD., has opened a showroom at Magnet House devoted entirely to industrial electric cooking equipment, in which there is a comprehensive display of "Magnet" apparatus designed and built for installation in hotel kitchens, restaurants, canteens, bakeries, &c. The showroom includes the following exhibits: Roasting ovens, double-oven ranges, compartment roasting ovens, cabinet roasting ovens, ship's galley ranges, bread-baking ovens, pastry ovens,

G.E.C. Industrial Cooking Showroom.

steaming ovens, dough-nut cookers, grillers, fish fryers, grilling and cooking plates, boiling tables, stock pots and soup boilers, vegetable boilers, bainmaries, hot cupboards, urns and water boilers. The apparatus displayed in this showroom is representative of similar equipments which have been built and supplied by the General Electric Co., and are in use all over the world, having been installed on board ship and also in hotels, hospitals, and canteens. A view of the showroom accompanies this note.

New French Company.

A new company has been formed in Paris (50, Rue de Lisbonne) with a capital of 9½ million francs, and the title La Société d'Electricité de Lille et de sa Banlieue, to extend the electricity supply facilities in the Lille district.

A Southport Development Booklet.

The Southport Electricity Department (engineer: Mr. E. Moxon) has produced an illustrated booklet dealing with the advantages of electric cooking and the facilities which the Department provides. A number of cookers are illustrated and particulars are given of the charges for the hire of these, and photographs of the showrooms and lecture theatre are reproduced. Two circulars, one in rhyme, are being sent out with the booklet to consumers in Southport. One of these circulars deals in a comprehensive way with domestic electricity. A cookery exhibition is at present being held at the showrooms.

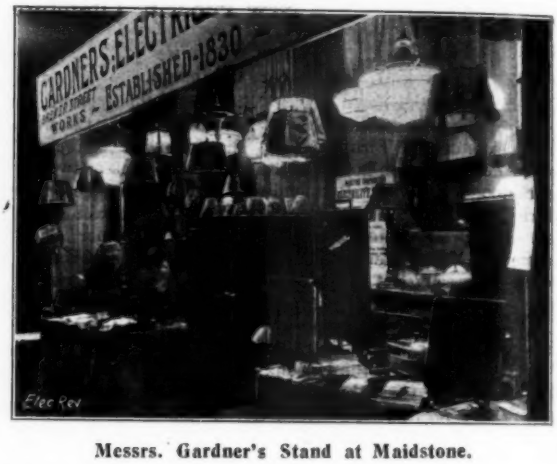
Recent Contracts.

Among the orders recently received by MESSRS. CECIL HODGES & CO., LTD., Dalston, are one for the lighting control switchgear, including the stage and projecting room switchboards, in the new Astoria Theatre, Charing Cross Road; and one for the extension of the switchboard at the Stationery Office depôt, Harrow, placed by the Office of Works.

The ANGLO-ARGENTINE GENERAL ELECTRIC CO., LTD., has recently secured an order for the whole of the lamps required for the offices of *La Prensa*, the prominent Buenos Aires newspaper. The lamps are of the "Osram" brand.

Local Exhibitions.

MAIDSTONE.—The illustration which accompanies this note depicts one of the stands arranged by Messrs. E. A. Gardner and Sons, Ltd., Maidstone, at the electrical exhibition recently held in that town. Messrs. Gardner are electrical contractors,



Messrs. Gardner's Stand at Maidstone.

but they also have a special branch, and showroom, for the retailing of electrical supplies. The stand illustrated displayed the products of a number of leading manufacturers; another stand was devoted to "Standard" appliances.

BASINGSTOKE.—An electrical exhibition was opened at the Town Hall on February 24th by the Mayoress (Mrs. C. Bowman), supported by the Mayor (Alderman Bowman), Sir Alfred Holbrook, M.P., Mr. F. Swarbrick, and Mr. V. W. Dale (E.D.A.). The Mayor, in his opening remarks, briefly outlined the history of the undertaking, and paid a tribute to Mr. Swarbrick's energy and enthusiasm. In declaring the exhibition open, the Mayoress said that the electrically-fitted rooms clearly demonstrated how electricity could brighten the home and lighten the labours of the home-makers. Sir Alfred Holbrook, M.P., and Mr. V. W. Dale also spoke. The exhibition consisted of a suite of three rooms, dining-room, lounge, and bedroom, tastefully furnished by Messrs. Moody & Co., and electrically equipped by the Credenda Conduits Co., Ltd. In addition, there was a separate exhibit of electric sewing machines, "Creda" cookers and fires. Mrs. Mole, assisted by Miss Swarbrick, gave a series of lectures and demonstrations throughout the exhibition. Prior to the opening of the exhibition, the Mayor started up the new 600-kW Diesel plant (Mirrlees-Bickerton) at the generating station in Brook Street.

CARDIFF.—A house designed on the lines of the E.D.A.-E.L.M.A. prize house by Messrs. Edwards & Jones, Cardiff, was opened recently at Cardiff Drill Hall. It was erected by Messrs. G. L. Ward & Co., Cardiff, and consists of a lounge, dining-room, two bedrooms, bathroom, lavatory, garage and scullery, all of which are electrically equipped. The exhibition is under the auspices of the *Western Mail*, and the house has been equipped by Messrs. David Morgan, in co-operation with Messrs. Ward. The appliances on view are representative of a number of the leading electrical companies.

DUMFRIES.—Mrs. O'Brien, wife of the Provost, opened on March 1st at St. George's Hall, Dumfries, an electrical exhibition organised by the local electrical contractors under the chairmanship of Mr. W. Johnston, burgh electrical engineer. Among the exhibitors are Metro-Vick Supplies, Ltd., the British Thomson-Houston Co., Ltd., the General Electric Co., Ltd., Belling & Co., Ackroyd & Best, Souter & Co., Ltd., the Edison Swan Electric Co., Ltd., Siemens & English Electric Lamp Co., Ltd., the Chloride Electrical Storage Co., Ltd., the Hotpoint Electrical Appliance Co., Ltd., and the Singer Sewing Machine Co. Messrs. R. Barbour and Sons, drapers, have fitted up a shop window with special and Sons, drapers, have fitted up a model shop window with special lighting.

Indian Electrical Imports.

The official returns show that the value of the electrical equipment imported into India during December last was 34,00,000 rupees, as compared with 23,26,500 rupees in December, 1925.

The Co-ordination of Government Contracts.

The Parliamentary Correspondent of the *Daily Telegraph* states that last session the Estimates Committee of the House of Commons made the valuable recommendation that a Co-ordination of Contracts Committee should be established for the purpose of arranging for the bulk purchase of supplies for a series of Government departments instead of each department continuing to place its own contracts. This recommendation, designed in the interests of economy, will shortly bear fruit, as it is understood that the Admiralty, the War Office, and the Air Ministry have now agreed to appoint representatives on the Committee. In addition, the Office of Works and the Post Office—departments which have heavy contracts—will participate, whilst the Treasury will naturally take a hand

Trade Announcements.

MEDWAY'S SAFETY LIFT CO., LTD., states that its telephone number has been changed to: Hop 4767-9.

Owing to their premises having been sold, MESSRS. HUBBER AND SON, electrical engineers, of 85 & 86, South Street, Exeter, are selling their stock-in-trade, plant, &c., by auction on March 21st.

THE WALSALL HARDWARE MANUFACTURING CO., LTD., last week opened a new store at Castle Warehouse, Nottingham, which will contain a full range of "Walsall" specialities, conduits, ironclad switch- and fuse-gear, &c., and will be under the personal direction of Mr. F. H. Blaxley.

The telephone number of Messrs. E. N. HUNTER & Co., 68, Victoria Street, S.W.1, is now "Victoria 0259."

MR. T. J. STOBART, 316, Ivydale Road, S.E.15, has been appointed sole representative in the British Isles for the Canadian directories of the Fraser Publishing Co., Montreal. The metal products (automotive, electrical, hardware, radio, machinery industries, &c.) directory of this series has just been published.

MR. J. E. FENTON, wireless and electrical engineer, has removed to 44-46, Canmore Street, Dunfermline.

New Catalogues and Lists.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, near Manchester.—Three illustrated and priced pamphlets dealing, respectively, with "mass" type batteries for long slow discharges; h.t. radio "mass" type batteries; and "Monobloc" automobile batteries.

THE CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, S.W.1.—An illustrated pamphlet advertising the "Cambridge" dial thermometer.

THE ELECTRICAL EQUIPMENT & CARBON CO., LTD., Bank Buildings, 109-111, New Oxford Street, W.C.1.—Price List S.C.7, dealing with "Siemens" carbons for kinematograph projection; and List M8, containing details and prices of "Elin" d.c. and a.c. motors.

MESSRS. ELLIOTT BROS. (LONDON), LTD., Century Works, Lewisham, S.E.13.—Catalogue sections containing illustrated descriptions of some new portable testing sets and the "Elliott" cable-core temperature indicator.

MESSRS. J. H. TUCKER & CO., LTD., King's Road, Tyseley, Birmingham.—A series of booklets, pamphlets, and folders illustrating and describing ironclad switch- and fuse-gear, tumbler switches, switchplates, and other "Tucker" products.

MESSRS. HANS RENOLD, LTD., Burnage Works, Didsbury, Manchester.—An illustrated brochure dealing with the company's chains and chain drives for power transmission.

THE B.E.N. PATENTS, LTD., 96-100, Victoria Street, S.W.1.—An illustrated folder advertising the "B.E.N.-Myers" hydraulic car-washing plant. Priced.

THE BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, W.C.2.—A folder containing illustrations and prices of electric light pendants, shade fittings, and lanterns.

MESSRS. ALLEN-LIVERSIDGE, LTD., Victoria Station House, S.W.1.—Catalogue E.W. Section 1 and E.W. Pamphlet 7 dealing exhaustively with "Pontelec" electric welding equipment (Buckley, Saunders & Co., Ltd.) and welding supplies, including rivet heaters. Fully illustrated.

SIEMENS & ENGLISH ELECTRIC LAMP CO., LTD., 38-39, Upper Thames Street, E.C.4.—Catalogue No. 164, containing illustrated particulars and prices of bowl fittings, "Silvaray," "Silvalux," and "Moonstone" glassware, alabaster bowls and other lighting fittings. Also March price sheet of electrical accessories, fittings, and appliances.

THE JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, S.W.1.—March calendar-blotter advertising the company's "203" cooker for hiring schemes.

THE D.P. BATTERY CO., LTD., Bakewell, Derbyshire.—A booklet illustrating and describing applications of "Kathanode" batteries for locomotives in power stations and works.

THE HART ACCUMULATOR CO., LTD., Stratford, E.15.—March calendar-blotter advertising the company's batteries; also three new showcards advertising the company's motor-car starting and lighting batteries.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—Leaflet 4,383, illustrating several examples of bakelite mouldings as produced by the company.

POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2.—March calendar-blotter advertising "Elasta" lamps.

FALCONBRIDGE & CO., Cefco Works, Beck Street, Nottingham.—A priced and illustrated catalogue of fan regulators, dimmers, arc resistances, curtain controllers, &c.

HOPKINSON INDUCTION MOTORS, Willesden Lane, North Acton, W.3.—March stock list of single- and three-phase motors.

Bankruptcy Proceedings.

D. T. DONOVAN and H. A. LANGLOIS, trading as the London Electrical Co., 119, St. Mary Street, Cardiff, formerly 124, Queen Street, Cardiff.—The adjourned public examination of these debtors was held recently at Cardiff. The statement of affairs showed a deficiency of £1,025. Debtor Langlois said he had been in business as an electrical engineer since 1921, having £50 capital when he commenced. In May, 1926, debtor Donovan joined him as a partner. He put £50 into the partnership when he joined. An accountant prepared a statement which showed a net profit for 12 months of £1,086 and a balance sheet showed stock in hand at £400. It was proposed to form a limited company with £2,000 capital, and premises were taken in St. Mary Street. Debtor Langlois agreed that in the last seven months between trading losses and private drawings their loss amounted to £986. An order was made for a statement showing goods received and payments made between certain dates, and the examination was further adjourned.

G. R. SIMS, Hartlepool Street, Thornley, Durham, motor and electrical engineer.—The public examination of this debtor was held on March 1st, at Durham. The statement of affairs showed ranking liabilities of £421, and there was a deficiency of £296. Debtor attributed his failure to the mining dispute. It appeared that he commenced business in 1924 and was successful until the beginning of the dispute, after which he had to sell some of his stock at a loss. The examination was adjourned.

A. H. RICHARDSON (Radio Supplies), wireless manufacturer, 4, Rose Hill, and Wellingborough Road, Finedon, Northants.—First meeting held March 8th, at the Official Receiver's Office, The Parade, Northampton; public examination, April 1st, at the County Hall, Northampton.

A. E. S. CHALLENER, wireless engineer, 277, St. Sepulchre Gate, Doncaster.—Last day for proofs for dividend, March 16th. Trustee, Mr. L. J. Clegg, Official Receiver's Offices, 14, Figtree Lane, Sheffield.

J. N. DAVENPORT and L. A. HACKETT (Davenport, Hackett and Co.), electrical engineers and contractors, 36, Spring Gardens, and Albert Mill, Albert Street, Manchester.—Second and final dividend of 3s. 2 9/50d. in the £, payable March 15th, at 21, Spring Gardens, Manchester.

G. E. GRAINGER (Grainger & Co.), wireless engineer, 38, Market Street, Ashby-de-la-Zouch.—Receiving order made February 28th, on debtor's own petition.

G. TURNER (Radio Supply Co.), electrician and wireless dealer, 34, Mesnes Street, Wigan.—First and final dividend of 3s. 10½d. in the £, payable March 18th, at the offices of the Official Receiver, 11, Dale Street, Liverpool.

Company Liquidations.

NEUTRON, LTD., Sicilian House, Southampton Row, W.C.—The first meetings of creditors and shareholders of this company were held on March 3rd, at Carey Street, a compulsory winding up order having been made on February 15th at the instance of a creditor. The Official Receiver reported that the company was registered on May 3rd, 1924, with a nominal capital of £500, and its primary object was to acquire the assets and business of William Bennison and T. E. de Vries, who were then dealing in the "Neutron" crystal. By an agreement dated June 30th, 1924, the company acquired from them the goodwill and assets of their business. The company undertook to pay all debts and liabilities of the vendors up to an agreed sum of £100. The purchase consideration was fixed at £394, which was satisfied by the issue of fully-paid shares. Mr. W. Wolsey, a director, had stated that shortly after the incorporation of the company an agreement was entered into with the firm of V. Zeitlin & Sons, by which the latter became sole distributors for Great Britain and Ireland of "Neutron" crystals. They transacted a considerable volume of business with the company, and, according to Wolsey, had paid sums amounting to approximately £45,000. There were agreements with other firms for distributing the "Neutron" and other crystals, and the position in regard to those would be required to be considered by the liquidator when appointed. There had been several issues of debentures, but inasmuch as certain of them were issued within three months of the commencement of the winding up for a past consideration they would appear to be void. A number of judgments were obtained against the company, and, as further capital could not be obtained, the directors, on January 18th last, decided to put the company into voluntary liquidation. On the same day Bennison, under the powers contained in his debentures, appointed a receiver on his behalf. On February 21st, however, the latter wrote to the Official Receiver, on behalf of Bennison, to the effect that he was retiring from the receivership and he had since handed over the estate to the Official Receiver. A receiver, appointed on February 7th by P. G. Marr & Co., Ltd., holders of debentures for £3,150, had not taken any action, with the result that the Official Receiver was in possession of the assets. No statement of the company's affairs had been lodged, but the unsecured

liabilities were estimated at £6,311, in addition to which there was a sum of £3,450 claimed to be due in respect of debentures. With regard to the assets, the book debts were estimated at £500. The Official Receiver had realised £65, and there was a balance of about £127 on the receiver's account, which was, however, subject to his remuneration and solicitor's costs. The chief assets of the company appeared to be goodwill. So far as could be ascertained at the present time about £20,000 had been expended by the company in advertising. The remaining assets consisted of crystals, wireless parts, tins, cartons, &c., and they were of small value unless the goodwill were bought. Two offers had been received for the goodwill, trade marks and stock, the higher of which amounted to £600. Wolsey attributed the failure of the company to excessive advertising. In Bennison's opinion the failure was due to excessive advertising and insufficient working capital to enable orders to be executed. The company had also kept a large and expensive staff, and had incurred losses in connection with the manufacture of and experimenting with radio sets. A liquidator was nominated.

Paragon Electric Welding Co., Ltd.—Winding up voluntarily. Liquidator, Mr. A. J. Francis, 25, Llanishen Street, Cardiff. A meeting of creditors was held at Merthyr House, Cardiff, on March 7th. Particulars of claims to the liquidator by March 31st.

Cinema Apparatus Co., Ltd.—Winding up voluntarily. Liquidator, Mr. F. Wheatcroft, 105, Market Street, Manchester. A meeting of creditors was held at the Liquidator's offices on March 9th. Particulars of claims by April 2nd.

Sterling Accessories, Ltd.—A meeting of members is called for April 6th, at the offices of Messrs. Thorpe & Pearson, 5, John Street, Bedford Row, W.C., to hear an account of the winding up from the liquidator, Mr. W. B. Pearson.

Autoveyors, Ltd.—Winding up voluntarily. Liquidator, Mr. E. W. Dilley, 84, Victoria Street, S.W. Meeting of creditors at 84, Victoria Street, S.W., March 15th.

Private Arrangements.

W. H. Taylor, radio engineer, 106, Bridge Street, Warrington.—A meeting of creditors was held recently, at the offices of Mr. J. Willett, solicitor, Warrington, when a statement of affairs was submitted which disclosed liabilities of £929, of which £529 was due to unsecured creditors, and the debtor's mother was a creditor for £400. The assets were valued at £151 net, leaving a deficiency of £778. It was reported that the debtor commenced in a small way after the war, and four years ago took the present premises. At that time he had no capital of his own, but borrowed £400 from his mother. Details as to the trading were not available, but the debtor stated that the turnover had been as high as £50 per week, and as low as £12 weekly. He attributed his present position to the long illness and subsequent death of his wife. It was decided that, subject to the debtor's mother withdrawing her claim, the estate should be dealt with under a deed of assignment in favour of Mr. P. S. Booth, Exchange Chambers, 2, Bixteth Street, Liverpool, as trustee, together with a committee of inspection consisting of Mr. W. Draper (Messrs. H. E. Beardsall, Ltd.), Mr. S. Lockwood, and Mr. J. F. Warburton. The following are creditors:—

	£		£
O'Brien, R. A., Ltd. ...	95	Bush House	50
Beardsall, W. B., & Co., Ltd.	60	Wood, E., Ltd.	30
Mullard Wireless Service Co., Ltd.	62	Bankers	28
		Mackay & Co., Ltd. ...	25
		B.N.B. Wireless, Ltd. ...	20

C. W. Page and T. K. Garrard, trading as the Southern Sales Co., Rye, Sussex, motor accessory dealers and electrical and wireless factors.—A committee of inspection, appointed at a meeting of creditors, recommends the adoption of a proposal whereby the business will be formed into a limited company and the claims of the present trading creditors secured by a first mortgage debenture.

Herbert Thomas Ellis, Earsham Street, Bungay, Suffolk, wireless and electrical engineer, &c.—A meeting of creditors was held on March 2nd, at the offices of Messrs. Harman and Gowen, 7, Queen Street, Norwich. A statement of affairs was presented which showed liabilities of £943, and assets of £305, leaving a deficiency of £638. Mr. Gowen reported that the debtor commenced business about five years ago with a capital of £400 or £500. He had kept a day book and cash book. No trading figures were available at the meeting. Mr. Gowen added that in consequence of pressure by creditors a deed of assignment had been executed in his favour on February 25th. The debtor had no offer to make, and attributed his position to bad trade and bad debts. The creditors decided that the deed of assignment should be confirmed, and that the trustee should make an immediate endeavour to sell the business as a going concern. The following are creditors:—

	£		£
Shell-Mex, Ltd.	100	Brown Bros.	25
S.D.H. Mfg. Co.	141	Harmsworth, Ltd. ...	40

Dissolutions of Partnership.

H. Van Leemputten & Beneu, manufacturers of wireless and gramophone cabinets, 157a, Stanhope Street, Euston Road, N.W.—Messrs. H. Van Leemputten and P. Deneu have dissolved partnership. Mr. Leemputten will attend to debts and continue the business in his own name.

Springvale Electrical Co., electrical engineers, Springvale Works, Masbro Road, West Kensington, W.—Mr. G. H. Armitage and Mr. D. Heaton have dissolved partnership. Mr. Armitage will attend to debts and continue the business.

Social Events.

Bad weather did not prevent the gathering together of a very large audience consisting of members of the London office staff and friends of W. T. Henley's Telegraph Works Co., Ltd., at a performance given by Henley's Dramatic Club on Saturday evening last, at the Cripplegate Theatre. Ian Hay's domestic comedy, "The Sport of Kings," was the piece presented, and the high standard of excellence for which the club is known was well maintained, if not surpassed. The audience was very appreciative, and we may add our own congratulations. Mr. Frank J. Bettley as Amos Purdie, J.P., was a marked success, and Miss Hilda Starbuck as his daughter Katie was charmingly natural and free. Messrs. A. V. Burnett and W. G. Turner filled prominent positions with ability. Miss Irene Bradbrook had an inconspicuous part to play as Mrs. Purdie, but she did it well. Indeed, everybody contributed his or her share in providing a most enjoyable evening.

The staff of the Bury Electricity Department held its annual dinner on February 28th, at the Royal Hotel, Bury. Mr. J. G. Potts, the borough electrical engineer, presided, and among those present were the chairman of the Electricity Committee (Councillor Evans), Messrs. J. Stephenson (resident engineer), J. Murray (works superintendent), S. J. Watson (Salford), Councillor J. Pilling, and Mr. J. Renshaw (Fleetwood). The dinner was followed by a concert.

On February 26th the Seecol Social and Sports Club (Strand Electric and Engineering Co., Ltd.) held a fancy dress dance at Hana's Studios, W. There was an excellent variety of costumes, and eight prizes were given by the directors. Music was provided by the Revels Dance Orchestra.

The Indoor Games Section of the G.E.C. Social and Athletic Club held a successful dance at the Lecture Room, Magnet House, on February 18th, arranged by Mr. H. J. Fisher, the hon. secretary of the section.

The Outdoor Section of the Osram-G.E.C. Lamp Works Social and Athletic Club held the sixth dance of the season at the Osram Works on February 19th, when over 300 members and their friends spent a most enjoyable evening.

The annual staff dinner of the Reliance Telephone Co., Ltd., was held at Anderton's Hotel, Fleet Street, on February 26th. Mr. E. Silbermann, managing director, presided, and in responding to the toast of "The Directors," proposed by Mr. W. T. Ashton, A.M.I.E.E., he referred to the growth of the company, and the excellent spirit of good fellowship and loyalty which prevailed amongst the employés. A concert followed, and the evening was brought to a close. A vote of thanks for those responsible for the arrangements was proposed by Mr. A. V. Cannon, sales manager.

New Showrooms and Offices.

The Barking Urban District Council has applied to the Electricity Commissioners for sanction to a loan of £4,000 for the provision of showrooms and offices for the Electricity Department.

The Accrington Corporation's electricity showrooms, in Burnley Road, were to be opened this week. During the past year the costs of running electric houses have been collected with a view to helping prospective tenants of all-electric houses.

Book Notices.

An illustrated folder has been issued by the Edison Swan Electric Co., Ltd., London, to show the way to construct an interesting crystal set l.f. amplifier, called the "R.C. Twosome." The circuit employs two valves (R.C.2 and P.V.2) with a resistance capacity coupling unit. A transformer is used to couple the crystal set with the first valve. The circuit is certainly exceedingly simple, and can be put together quickly at a low cost. The design is not to increase the range of the crystal set with which it is incorporated, but to amplify the signals received so as to operate a loud speaker. The simple operations of building the set are very clearly explained in the instruction folder (complete with blue-print) which is issued free.

Messrs. Adam Hilger, Ltd., have issued a booklet dealing with developments in spectrography, &c., during the year ended June 30th last. This contains particulars of new instruments devised by the company and a digest of the literature of the subject published during the year. It also embodies a list of orders obtained by the company from all parts of the world.

"Doubling Our Coal Power" is the title of a pamphlet by Mr. A. Allport, who has made a close study of fuel economy for upwards of 15 years; he holds, and claims to prove, that low-temperature carbonisation is to-day a commercial proposition, and has issued this pamphlet at his own expense to set out the advantages of the "Coalite" process. (Wadsworth & Co., Keighley, price 6d.)

"Notes on Electricity and Service Electrical Apparatus as Applied to 1926 Artillery." London: H.M. Stationery Office. Price 2s. net.

"Controllers for Electric Motors," by H. D. James. Pp. vi+522; figs. 444. London: Chapman & Hall, Ltd. Price 21s. net.

"Mesures Electriques," by J. Granier. Pp. 200; figs. 85. Paris: Armand Colin. Price 9 fr.

Registered Electrical Contractors.

The following applications for registration were accepted by the Executive Committee of the National Register of Electric Installation Contractors on March 4th :—

Grotecke, K., Heaton Chapel, Stockport.
Contes & Co., Harrogate.
Lyons, W. H., Manchester.
Lea Bros., Birmingham.
Cooper, C., & Co. (London), Ltd., South Kensington.
Cooper, W. R., Redcar.
Keep & Roebuck, Sheffield.
Shawcross, J. T., Old Trafford, Manchester.
Morement & Bridges, Calne.
Hammond & King, Nottingham.
Elliott, R. H., Newbiggin-by-Sea.

For Sale.

The Crittall Manufacturing Co., Ltd., has for disposal several surplus generating sets. Nottingham Corporation Electricity Department invites offers for surplus generating plant, &c., at the St. Anns and North Wilford power stations. Barking U.D.C. Electricity Department has for disposal boilers, feed pumps and generating sets. The superintending engineer, Coastal District R.A.F., invites offers for one 44-kVA Siemens alternator, one turbine pump, two 440-V a.c., and one 220-V d.c., motors and one 10-kW Siemens generator, all lying at the Leuchars Aerodrome, Scotland. (See our advertisement pages to-day.)

Prices of Raw Materials.

Messrs. James Forster & Co., reporting on March 5th, stated :—" Closing prices of lead yesterday were £28 17s. 6d. for March, and £29 5s. for June, a rise on the week of 12s. 6d. per ton. . . . There is a slow but steady improvement in demand from all branches of the trade in this country, even cable manufacturers absorbing slightly larger quantities than heretofore. Increased activity is reported from the Continent, where Germany and Russia have been buying considerable quantities. In the United States also firmer conditions prevail. . . . Supplies here are still ample. . . . Reviewing the position as a whole, we can see no reason to anticipate other than continued firm markets with higher prices."

The following prices are only general, and they may vary according to quantities and other circumstances :—

CHEMICALS, &c.	Price Mar. 8th.	Fortnight's inc. or dec.
a Acid, Oxalic ... ... per lb.	5½d.	...
a Ammoniac, Sal ... ... per ton.	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£25	...
a Copper Sulphate ... ... ,,	£25 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	5½d.	...
a Shellac ... ... per cwt.	£13 10s.	...
a Sulphur, Commercial ... ... ,,	£9 10s.	...
a ,, Roll ... ... ,,	£9 10s.	...
a Soda, Chlorate ... ... per lb.	3½d. to 3¾d.	...
a ,, Crystals ... ... per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots... ... ... per ton.	£107 to £112	...
b ,, Wire ... ... per lb.	1/6 to 2/-	...
b ,, Sheet ... ... ,,	1/3 to 2/9	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net.	£274	£3 inc.
Grade II ... ... ,, ,,	£190	£3 inc.
Grade III... ... ... ,, ,,	£98	£2 inc.
c Brass (rolled metal 2" to 12" basis) per lb.	9¾d.	...
c ,, Tubes (solid drawn) ... ,,	11½d to 11¾d.	...
c ,, Wire, basis ... ... ,,	9¾d.	...
c Copper Tubes (solid drawn) ... ,,	1/0½	...
c ,, Bars (best selected) ... per ton.	£86	...
c ,, Sheet ... ... ,,	£86	...
c ,, Rod ... ... ,,	£86	...
d ,, (Electrolytic) Bars ... ,,	£63 2s. 6d.	£2/6 inc.
d ,, ,, Sheets ... ,,	£144 10s.	...
d ,, ,, Wire Rods ,,	£73 2s. 6d.	£2/6 dec.
d ,, ,, H.C. Wire per lb.	9½d.	½d. inc.
f Ebonite Rod ... ... ,,	2/3 to 2/6	...
f ,, Sheet ... ... ,,	2/3 to 2/6	...
n German Silver Wire ... ... ,,	2/3	...
h Gutta-percha, fine ... ... ,,	8/-	...
h India-rubber, Para fine ... ... ,,	1/6	2½d. inc.
l Iron Pig (Cleveland No. 3.) ... per ton.	122/6	...
l ,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g Lead, English pig ... ... ,,	£29 15s.	5s. inc.
g Mercury ... ... per bot.	£17 15s. to £18	10s. inc.
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/8	...
p ,, ,, rolled strip & sheet ,,	1/9½	...
p ,, ,, wire... ... ... ,,	1/9½	½d. dec.
o Platinum ... ... per oz.	£98	...
d Silicium Bronze Wire ... ... per lb.	10½d.	½d. dec.
r Steel, Magnet, in bars ... ... ,,	7½d.	...
a Tin, Block (English) ... ... per ton.	£310 to £311	£3 to £3 10s. inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	4/9	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co,. Ltd
g James & Shakespeare.
h Edward Hill & Co.
l Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Lighting and Power Notes.

Aldershot.—NEW PLANT.—As the result of a further interview with the Electricity Commissioners, the borough electrical engineer has been asked to submit to them for consideration a scheme for the installation of new plant at the electricity works. It is proposed to install two internal-combustion engines of 600 b.h.p. each, together with generators, auxiliaries, switchgear, and necessary interconnecting cables, at an approximate cost of £16,000.

Alsager.—INAUGURATION OF SUPPLY.—The formal inauguration of the supply of electricty for the district took place on February 26th, the chairman of the Urban District Council switching on the supply, which is provided by the Electricity Distribution of North Wales and District, Ltd.

Barnes.—ELECTRICITY IN SMALL HOUSES.—The Housing Committee of the L.C.C. has recommended that electricity be installed for lighting, cooking, heating and domestic purposes in 57 houses on the Castelnau housing estate, and that 599 houses be wired for lighting only. The Urban District Council will lay the cables on the whole of the estate and provide the necessary services free of charge to the L.C.C., but the latter will undertake the wiring of the houses. The charges will be 4d. per kWh for lighting, with an alternative tariff of 2½ per cent. of the rateable value of the premises per quarter, plus ½d. per kWh during the summer months and 1d. per kWh during the winter months for electricity consumed. The cost of the scheme to the L.C.C. will be £1,082 for wiring the 57 houses for lighting, cooking and heating, and £6,887 for wiring 599 houses for lighting only.

Basingstoke.—EXTENSION OF SUPPLY.—The Town Council is applying for a Special Order authorising it to supply electricity within the area of the Rural District Council. The estimated cost of the extension is £20,020.

OPPOSITION TO BILL.—The Council has also decided to oppose the Wessex Electricity Bill.

Bicester.—ELECTRICITY SUPPLY.—The Urban District Council has consented to an application by Messrs. Cooper & Hanns for a Special Order to supply electricity to the town. The maximum prices proposed are 1s. per kWh for lighting, 4d. per kWh for power, and 6d. per kWh for public lighting.

Bridport.—INQUIRY.—An inquiry was opened on February 25th by Col. T. C. Ekin, for the Electricity Commissioners, relative to a proposal by the Town Council to carry out an electricity scheme. Opposition was made by the Rural District Council, which sought to include a time limit in which the work should be carried out, the Manufacturers' Association, which ask for the insertion of a clause safeguarding the rates, and by the local gas company.

Burnley.—MAINS EXTENSIONS.—The Corporation is to carry out extensions to feeders and distributing cables, at a cost of £5,000.

Clitheroe.—INAUGURATION OF SUPPLY.—The power station was to be opened on Wednesday last. The Corporation has undertaken to wire houses and to charge slightly in excess of the standard charge per kWh until the cost of wiring is met.

Continental.—FRANCE.—A group has been formed in the Senate to do all in its power to further the exploitation of the country's numerous waterfalls. This group will keep before it the idea of the electrification of railways, the employment of electricity in all the domains where it is feasible, and the speeding-up of the construction of the necessary power stations.

The Paris-Orleans Railway Co. has placed a contract for the establishment of a h.p. transmission line between the hydro-electric station at Eguzon and a transformer station at Maregis. The line is to be capable of transmitting electricity at a pressure of 220,000 V, but at first the pressure will be limited to 150,000 V.

SWITZERLAND.—A scheme is under consideration for the erection of a large hydro-electric power station to utilise the water power of the Rivers Inn and Spols in the Lower Engadine. It is estimated that by the construction of three dams, a total of 230,000 h.p. can be made available.

BELGIUM.—A new central electricity station has recently been completed in Ghent, the plant comprising two 10,000-kW steam turbo generators. The old station, which has a capacity of 3,000 kW, is being converted into a transformer station.

Derby.—ELECTRICITY EXTENSIONS.—The Corporation proposes to borrow £83,500 for the following electricity extensions :—Mains, £45,000; transformers, £10,000; motors, £3,000; boiler house plant, £25,500.

Edinburgh.—ELECTRICITY EXTENSIONS.—At the Dean of Guild Court on March 3rd, plans were passed for the erection at the Corporation's power station at Portobello of a turbine house and a switch house, part of an extension scheme which will cost about £200,000. The new turbine house will contain two 25,000-kW turbo-alternators. Plans for additions to

the pump house have already been passed and an application for permission to extend the boiler house will come before the Dean of Guild Court soon. The extensions are being pushed on with a view to an additional supply of electricity being made available by the winter of 1928.

Harrogate.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer, Mr. G. Wilkinson) for the year ended March 31st last, show a total income of £52,690, as compared with £49,450 in the preceding year. Working expenses amounted to £28,965, as against £25,121, leaving a gross profit of £23,725 (£24,329). Capital charges absorbed £10,277, and there was a net surplus of £13,448, as compared with £11,343 in 1924-25. The capital expenditure during the year amounted to £24,436, the chief item being £14,560 for machinery. The sales of electrical energy increased from 3,782,411 to 4,495,011 kWh, and the maximum supply demanded from 2,397 to 2,793 kW.

Horsham.—OPPOSITION TO ORDER.—The Urban District Council is to oppose an application for an Order by the Electric Supply Corporation, Ltd., to supply electricity in areas adjoining the Council's area, which are included in an extension scheme contemplated by the Council.

Japan.—ELECTRICAL DEVELOPMENT.—Work has commenced on the construction of a steam power plant for the I.G.R. which will have a capacity of 60,000 kW. The cost is estimated at 5,000,000 yen.

The Lugawa Denryoku K.K. is to utilise the Azuma river for generating electricity, and the first section of its scheme provides for the erection of a power station at Matsudani with a capacity of 22,700 kW.

The new power station of the Tokyo Denryoku K.K., at Tajima-machi, Kanagawa-ken, has recently been completed. Two 35,000-kW sets have been installed.

Kirkham.—ELECTRICITY SUPPLY.—There has been a favourable response to the *questionnaire* sent out by the Urban District Council regarding the probable demand for electricity in the area, and it has been decided to apply for an Order to proceed with the scheme. It has not yet been decided whether the Council will carry out the scheme itself or place it in the hands of the Preston Town Council.

Leeds.—LOAN SANCTIONED.—The Corporation Electricity Committee has obtained sanction to the borrowing of £95,000 for services.

Liverpool.—ELECTRICITY CHARGES.—The Corporation Electricity Department will introduce from March 31st a new scale of charges for combined business and private premises, being a fixed quarterly charge of 7 per cent. on the ratable value with a minimum assessment of £18, plus ½d. per kWh for electricity consumed in Liverpool, Bootle, and Litherland, and ¾d. per kWh in Waterloo and Gt. Crosby.

Llandudno.—SUPPLY FOR SMALL HOUSES.—In all future municipal housing schemes, the Council has decided that provision shall be made for electric wiring.

Lytham-St. Annes.—LOAN.—The Town Council is applying for sanction to borrow £5,000 for the purchase of electrical apparatus to be let out on hire.

Manchester.—PROGRESS DURING JANUARY.—During the month of January the Corporation electricity undertaking showed an increase in connections of 1,885 kW, bringing the total to 301,934 kW; and the number of applications received for supply, including consumers for additional supplies, was 916, representing a total of 3,624 kW. The number of hired cookers connected increased by 97, bringing the total actually on circuit to 2,788. Applications for the hire of cookers totalled 129. A new 7,500-kVA, 33,000/6,600-V transformer was put into commission at Oldham Road sub-station, and one 500-kVA transformer was installed at Connolly's (Blackley). Ltd., sub-station in place of two 125-kVA transformers.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

STOKE-ON-TRENT.—Multi-part tariff for domestic consumers: 5s. per room per quarter, plus 1d. per kWh for the first 1,000 kWh per quarter, ¾d. per kWh for the next 1,000, and ½d. per kWh for all energy consumed in excess of this amount.

PREESALL.—Lighting: 8d. per kWh.

BIRKENHEAD.—The 10 per cent. increase made in September last to be withdrawn.

GRANTHAM.—*The Urban Electric Supply Co., Ltd.*—Lighting: From 10d. to 9d. per kWh; the increase made in the charges for power and heating owing to the coal dispute is to be discontinued.

WALLASEY.—Lighting reduced to 4½d. per kWh, and in addition a discount of 5 per cent., for prompt payment of accounts to consumers on lighting, heating, cooking, and small power tariffs. No increase was made to this class of consumer during the coal dispute.

HAMPSTEAD.—The flat rate for lighting reduced from 4d. to 3½d. per kWh, the charges for cooking, heating, and power to remain as at present, *viz.*, 1d. per kWh. Mr. J. Leadbeater, borough electrical engineer, states that this is the lowest flat rate charge in the London and Home Counties area, and one of the lowest in the country.

SOUTHAMPTON.—The increase of 20 per cent. for lighting, heating, cooking and power, made owing to the higher cost of coal, is to be withdrawn.

Reigate.—NEW PLANT.—The Town Council has applied for consent to install an additional generating set with a capacity of from 800 to 1,000 kW, at an estimated cost of £20,000, plus £1,000 for foundations. Inquiries are also to be made as to the possibility of a supply of electricity in bulk, and the terms.

Sandbach.—INAUGURATION OF SUPPLY.—An electricity supply for the district was formally inaugurated by the chairman of the Urban District Council on February 26th. Electricity is obtained from the Electricity Distribution of North Wales and District, Ltd.

Sheffield.—INQUIRY.—An inquiry was held by the Electricity Commissioners at Sheffield recently concerning the claims of rival undertakings to supply Cudworth, near Barnsley, with electricity. The Electrical Distribution of Yorkshire, Ltd., applied for statutory powers to supply Cudworth and Billingley. The Carlton Main Colliery Co. is already supplying electricity in Cudworth, where the Power Company is also supplying a number of consumers. For the Distribution Co. it was stated that it had not been successful in obtaining the consent of the Cudworth Urban Council, and it asked that such consent be dispensed with. The Colliery Co. had three pits, and at Frickley a generating station had been erected, linked up with the other two pits. It was the obvious intention of the colliery company to compete with the power company without incurring any of the statutory restrictions and obligations which the allied companies would be under if they obtained the Order. Mr. W. B. Woodhouse, engineer and manager of the Distribution Co., suggested that the colliery company took steps regarding supply after it knew of the impending application of the Distribution Co. He contended that it would be safer for the people to get a supply from the Distribution Co. because it would be subject to Government control and the prices regulated by the Electricity Commissioners. For the Cudworth Council, Col. Raley said that all through the prices charged by the colliery company had been lower than those of the Distribution Co., and the latter did not make any definite terms until the Council was morally and legally bound to the colliery company, whose terms were cheaper. The Commissioners will give their decision in due course.

Sidmouth.—ELECTRICITY SUPPLY.—It was reported at the February meeting of the Urban District Council that the Electricity Committee hoped to be able to announce a reduction in the price of current at the next meeting, to come into operation as from March 31st. The Committee recommended the Council to adjourn *sine die* the proposed provision of a new generating set at the electricity works at an estimated cost of £3,500, as it was felt that the expenditure for standby plant was not justifiable at present.

Southend-on-Sea.—NEW POWER STATION.—At a meeting of the Town Council on March 7th, it was decided to apply for sanction to erect a new power station at Hole Haven, on Canvey Island, at an estimated cost of £649,000. The station will have a capacity of 25,000 kW.

South Shields.—ELECTRICAL PROGRESS.—The electrical engineer reports that under the assisted wiring scheme 983 additional consumers were connected during the December quarter. Electricity sold totalled 212,053 kWh, and the revenue obtained was £5,750. Since the inception of the scheme a total revenue of £17,398 has been obtained from this source.

Special Orders.—Application has been made to the Electricity Commissioners by Basingstoke Corporation for a Special Order authorising it to extend its area of electricity supply so as to include certain parishes in the rural districts of Basingstoke, Kingsclere, and Whitchurch.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising Messrs. E. H. Leach and W. H. Phillips to supply electricity in the borough of Tenby; Major C. H. B. Prescott-Westcar to supply in the urban district of Axminster, the borough of Chard, and part of the rural districts of Axminster and Chard; the Tilbury Urban District Council to supply electricity in its area, and for the amendment of the Romford and District Electric Lighting Order, 1913; and the Crowborough District Gas and Electricity Co., to raise additional capital for electricity purposes.

Stoke-on-Trent.—CHANGE-OVER.—At a recent meeting of the Corporation Electricity Committee the engineer reported upon the change over of supply to consumers in the centre of Tunstall, and was instructed to carry out the work over a period of three years at an estimated cost of £6,000.

SUPPLY TO UTTOXETER.—The Committee has received a letter from Mr. W. C. C. Hawtyne, consulting engineer to the Uttoxeter Urban District Council with regard to a supply of electricity, and the Committee has informed him that the Corporation would give a supply at the city boundary provided the Council would erect the necessary line to take supply thereat.

LOANS SANCTIONED.—The Corporation Electricity Committee has received sanction to loans totalling £23,100 for mains, services, and sub-station plant.

Torpoint.—ELECTRICITY SUPPLY.—It was reported at a meeting of the Urban District Council on March 3rd that representatives of the Torpoint Electricity Supply Co., Ltd., had attended a private meeting of the Council and made definite proposals with a view to securing the withdrawal of the

Council's application and asking for its support to the company's application. Contingent upon this, the company offered a reduction in the price of electricity, which it promised to obtain from Plymouth as soon as it was economically possible, and also made proposals regarding the removal of the overhead wires in Fore Street. The Council had been given a definite assurance that if it supported the application of the company the cable would be laid across the River Tamar from Plymouth within three years of the date of the Order.

Wallasey.—ELECTRICITY EXTENSIONS.—The Corporation has prepared a scheme for extensions to the electricity works involving the expenditure of £150,000. The scheme includes the installation of a new 12,500-kW turbo-alternator and two boilers, thus doubling the capacity of the station. Tenders will shortly be invited for the supply of new plant.

Wirksworth.—STREET LIGHTING.—The Urban District Council has accepted an offer by the Derbyshire and Nottinghamshire Electric Power Co., to pay the cost of converting the street lamps on the route of the cables, and maintain and light them at a cost to the Council of £3 10s. per lamp per annum. The agreement is for a period of three years.

Worthing.—STREET LIGHTING.—The Corporation is to convert the existing street lamps from gas to electric lighting, and all the 60-watt lamps are to be replaced by lamps of 100 watts. The total cost of the scheme is £4,000.

Tramway and Railway Notes.

Continental.—BELGIUM.—The Chamber, by 73 votes to 61, has decided to abandon the proposed underground railway, linking up the north and south stations in Brussels.—*Reuter* (Brussels).

GERMANY.—Work is well in hand on the electrification of the railway between Munich and Rosenheim, Bavaria. Electric trains are already in operation on part of the line, which is expected to be completed by May next.

AUSTRIA.—The electrification of the last section of the State railway between Innsbruck and Bregenz—that between Feldkirch and Bregenz—has recently been completed.

SPAIN.—A concession has been granted for the construction of an electric tramway to connect the Granada-La Zubia railway with Monachil.

SWITZERLAND.—Last week a new line was opened at Zurich on the left bank of the lake. For years this section of railway has given trouble to both the town authorities and the Federal Railways, as Zurich has grown so rapidly and has so spread out, that the line which formerly ran outside the city, passed inside it and cut through no fewer than twelve streets. In order to avoid the danger of such a state of affairs, the city voted 20 millions of francs, and the Federal Railways 30 millions, towards the cost of a new line. This is at last finished, and is, of course, electric. Special attention has had to be given to the tunnels, one of which passes under the bed of the River Sihl, and has been specially lined to ensure its being perfectly watertight. This Wiedikon tunnel is 507 metres long, the Ulmberg one is 260 metres, and the Willishofen tunnel is 903 metres. A new station has been built at Enge.

Halifax.—TRACK RENEWALS.—The Tramways Committee has recommended the renewal of the tramway track from Ratten Clough to Causeway Foot, at an estimated cost of £3,467.

Japan.—TOKIO.—The first underground railway which is being constructed by the Tokio Underground Railway Co., Ltd., is expected to be completed by the end of this month, and work on the construction of the second line will be commenced shortly.

RAILWAY ELECTRIFICATION.—It is understood that the Kurihara Kido K.K. at Wakayagimachi, Migagi-ken, intends to electrify its railway at an estimated cost of 550,000 yen.

A scheme is in hand for the formation of a company, with a capital of 250,000,000 yen, for the construction of a rapid transit electric railway between Osaka and Tokio.

Plans are being prepared for the electrification of 337 miles of the following Government lines:—Tokaido Line, Atami-Numazu, 13 miles; Numazu-Akashi, 300 miles; Takata-Omiya, 14 miles; and Kobubunju-Hachioji, 10 miles. According to *Commerce Reports*, the Tokaido line extensions consist of two separate projects which, when completed, will form one continuous line. The first extension from Atami to Numazu will link the former with the Tokaido main line at Numazu. The 300-mile stretch between Numazu and Akashi is perhaps the most important project yet contemplated, since it includes the electrification of one of the heaviest traffic railway divisions in the empire. That portion of the Tokaido system now electrified, together with the proposed extension, will serve 16 prominent towns and cities. Three of the most important sea ports are situated within its limits, as well as the largest manufacturing centres.

Liverpool.—NEW CARS.—The Ministry of Transport has sanctioned the borrowing by the Corporation of £74,000 for the provision of new tramcars.

Newcastle-on-Tyne.—NEW ROUTE.—The Corporation Transport Committee has recommended the laying of a tramway track across the new high-level bridge over the Tyne, now in course of construction, to form another connection between Northumberland and Durham. The estimated cost is £19,000, plus £3,000 for equipment.

Telegraph and Telephone Notes.

"Beam" Radio-Telegraphy.—AUSTRALIAN SERVICE TESTS.—On March 7th, Post Office authorities commenced re-testing "beam" wireless communication between the Marconi Company's stations at Grimsby and Skegness and the Australian stations near Melbourne.

Bolivia.—NEW RADIO STATION.—Congress has granted 30,000 bolivianos for the erection of a wireless station at Magdalena, the capital of the Province of Iténez. The province has a population of only 95,000, or just over 0.5 per square mile.—*Reuter's Trade Service* (La Paz).

France.—RADIO-TELEPHONY.—The Algiers Chamber of Commerce recently discussed the subject of wireless telephony between France and Algeria. After considering the conclusions arrived at by the Constantine Chamber of Commerce, the Algiers Chamber declared that it was of the opinion that wireless telephone communication between France and Algeria would offer the greatest advantages, particularly in intensifying the relations between the two countries and in relieving the cables. The Chamber expressed the wish that the French Post, Telegraph and Telephone Administration should study a plan for the establishment of wireless telephony between France and Algeria.—*Reuter's Trade Service* (Paris).

Germany.—BERLIN-NEW YORK TELEGRAPHY.—After a lapse of twelve years, Germany can once more telegraph direct to the United States, for on March 4th the newly-laid Emden-Azores cable was officially declared to be in service by the Minister of Posts and Telegraphs, Dr. Schaetzle, at a banquet in Berlin to celebrate the occasion. Soon after war broke out, all German cable lines to the United States were cut by the Allies, and ever since telegrams from Germany to the United States have had to be transmitted through foreign cable companies. The new cable of the German Atlantic Telegraph Co. runs as far as the Azores, where it connects with the lines of the Western Union and the Commercial Cable Companies, so that messages can now be sent direct from Emden to New York.—*Reuter* (Berlin).

League of Nations.—PROPOSED RADIO STATION.—At the 44th session of the League of Nations Council, which commenced at Geneva, Switzerland, on March 7th, a proposal to build a special wireless station to enable the League to communicate with all Governments in emergency was to be discussed. The *Daily Mail* understands that the chief objection to the project is the cost.

Russia.—AUTOMATIC TELEPHONY.—The Nizhni-Novgorod telephone works has begun to manufacture automatic telephone apparatus. This apparatus will be installed by the Commissariat of Posts and Telegraphs on its new system.—*Reuter's Trade Service* (Moscow).

South America.—TELEPHONE STATISTICS.—The extent and growth of the telephone lines of the two companies which operate in Buenos Aires and in neighbouring provinces, such as Buenos Aires, Santa Fé, and Cordoba, may be estimated from the following statistics recorded in Messrs. Tornquist and Co.'s recent report:—

Companies.	No. of offices.	Number of Apparatus. Capital and suburbs.	Interior.	Total.
United R. Plate Telephone Co.	336	106.128	51.892	158.020
Soc. Co-operativa Telefónica	26	6.609	1.026	7.635
Total, 1926 ...	362	112.737	52.918	165.655
Total, 1925 ...	334	104.895	45.390	150.285

The United River Plate Telephone Co. is constantly extending its radius of action. The increase in the number of apparatus in 12 months was more than 15,000, equivalent to 10 per cent.

The Telephone Service.—STATISTICS.—Official figures show that there were 1,510,775 telephones in use in Great Britain and Northern Ireland up to December 31st, 1926, made up of 1,477,003 Post Office telephones, 21,736 in the Hull, Guernsey and Jersey systems, and 12,036 private stations connected

with the Post Office system. The total represents an average of 34 telephones for every 1,000 inhabitants in the area.

AUTOMATIC EXCHANGES.—The comprehensive programme of automatic telephone conversion which is being carried out this year by the Post Office provides for installations in 12 provincial towns (making, with the 35 already equipped, 47 in all) and for four installations in London. Holborn and Bishopsgate will be the first London exchanges to be converted, and later in the year Sloane and Western exchanges will follow. In the provinces the work has already begun; Harrogate was "cut over" on February 26th, and Sheffield's installation on March 5th. At intervals the change will be made at Halifax, Hanley, Wakefield, Exeter, Nottingham, Colwyn Bay, Burnley, Brighton, Leicester, and Southport.

Transatlantic Telephony.—NEW RECEIVING STATION.—Work at the transatlantic wireless telephony receiving station at Kemback, near Cupar, is progressing. The land line linking the station with the local post office has been completed, and in the power house four dynamos, as well as the engines for driving them, have been placed in position, and the large control board and switchboard have been fitted up. Two types of receiving apparatus, one of American and one of British make, are in course of being built at the receiving hut. Dr. Baillie, of the Bell Telephone Co., New York, is in charge of the installation of the American receiving apparatus.

GERMANY'S APPLICATION.—The German Post Office has asked the British Post Office whether, in view of the good results attending the experiments in telephony between Frankfort and New York, *via* London, it will be possible to include Germany in the transatlantic telephone service. The British Post Office has not yet replied.—*Reuter* (Berlin).

Radio Notes.

Amateur Broadcasting.—MANCHESTER STATION.—Mr. J. E. Kemp, chairman of the Manchester Branch of the Wireless League, is one of the chief members of the Manchester Radio Scientific Society, which recently opened a new transmitting station with call sign 2HD. Mr. Kemp has stated that the Society is a purely scientific body experimenting by unorthodox methods. *The Times* reports him as follows:—"We are merely a research station with about 80 members, affiliated to the Association of Radio Societies, and our area extends to Preston on the north, Crewe on the south, and the West Riding of Yorkshire on the east. We are giving experimental transmissions to our members on a wave-length of 440 metres on Sunday afternoons, using 10 watts. All who contributed to the programme did so voluntarily, and all the money subscribed by members goes in material for the upkeep of the station and for research work." The matter has been raised in the House of Commons, and it is understood that the Postmaster-General has cancelled the licence granted to 2HD, and has issued a new licence which, it is stated, will make further concerts such as those broadcast in the past impossible, but a *Daily Mail* reporter has been told that the Society intends to continue broadcasting and will risk the consequences.

Canada.—LICENCES.—Listeners who "dodge" the dollar licence fee are liable to visits by Dominion Government inspectors, accompanied by Royal Canadian mounted policemen who may ask to see the receipt for the fee, says *World Radio*. Commander Edwards, of the Radio Branch, has ordered a drive in Toronto, Ottawa, Montreal, Halifax, and Victoria to round up the fee "dodgers," who are estimated to number nearly two hundred thousand. The maximum fine is £10 and costs, but the usual fine for a first offence is £1 and costs. Of the estimated 350,000 owners of radio receiving sets in Canada only 168,000 have taken out licences.

WAVE-LENGTHS.—Under the arrangements with the United States Department of Commerce, Canada is supposed to use 17 wave-lengths, six exclusive and eleven jointly with United States stations.

China. — REGULATIONS. — Radio broadcasting has been officially recognised in Manchuria and regulations for its control established; at present the facilities are very limited. The North-Eastern Wireless Long-Distance Telephone Service, an official Chinese bureau in Mukden controlling Chinese wireless communication in Manchuria, which is erecting a broadcasting station in the three eastern provinces, has promulgated regulations which, *Commerce Reports* says, will govern broadcasting and the importation, sale, and installation of receiving sets and parts in Manchuria.

Paraguay.—NEW STATION.—When a receiving and broadcasting station at Asunción was approaching completion its range was found to be only 180 kilometres, and, as this is insufficient, another transmitter of greater power has been ordered and will soon be installed. The country (200,000 square miles in area) is generally flat, and of the whole population (approaching 1,000,000) only 8 per cent. are tribal Indians. A radio club has already been formed with a considerable membership. Messages are received from Buenos Aires, Rosario, Sao Paulo, Rio de Janeiro, and other stations in Argentina and Brazil.—*Reuter's Trade Service* (Asunción).

Rumania.—NEW COMPANY.—A Rumanian company is to be established which will monopolise broadcasting and the manufacture of radio apparatus, and possibly telephone and telegraph apparatus. The International Radio Broadcasting Commission of Geneva has allotted a wave-length of 236.2 metres to Bucharest, says *Commerce Reports*, but the local director of radio communication has requested permission to use a wave-length of 460.5 metres.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Adwick-le-Street.—March 21st. Urban District Council. Cables, boxes, pillars, and necessary materials and apparatus for a distribution network scheme. (March 4th.)

Ashford.—March 14th. Electricity Department. Two electrically-driven centrifugal pumps (capacity 30,000 gal. per hour). (February 25th.)

Australia.—MELBOURNE.—April 26th. Postmaster-General's Department. Telephone switches. (B.X. 3254.)* Instrument cords. (B.X. 3255.)*
April 12th. Cord-type switchboards. (B.X. 3280.)*
May 17th. Resistances and Reactances. (B.X. 3307.)*
May 23rd. State Electricity Commission. Switchgear and accessories. (B.X. 3285.)*

Ayr.—March 23rd. Ayrshire Education Authority. Electric lighting and central heating of new primary school at Irvine. Plans with Master of Works, Education Offices.

Brecon.—March 16th. Electricity Department. Generating plant and switchgear, battery of accumulators and connections, underground and overhead lines. (February 25th.)

Dumfries.—March 16th. Dumfriesshire Unionist Association. Electric lighting and heating installation at headquarters building. Messrs. J. Barbour & Bowie, architects, 27, Castle Street, Dumfries.

Edinburgh. — March 21st. Electricity Department. Twelve months' supply of cables, box frames and covers, house service fuse boxes and fuseboards, meters and meter boards. (March 4th.)

Erith.—March 24th. Electricity Department. H.p. and l.p. underground cables, joint boxes, &c. (See this issue.)

Hamilton.—County of Lanark District Committee of the Middle Ward. Electric lighting installation in connection with the erection of 190 houses. Mr. P. C. Smith, District Offices, Hamilton.

Hazell Grove and Bramhall.—March 23rd. Urban District Council. One oil circuit breaker and kiosk and seven 20-kW transformers and kiosks, cables and two e.h.p. substation switchgear panels. (March 4th.)

Ilford.—March 22nd. One 500-kW rotary convertor, with transformer, switchgear, &c. (March 4th.)

India.—March 22nd. India Store Department. Two 250-kW Diesel-engine alternator sets, with switchgear, transformer, &c. (February 18th.) 30,000 oil insulators. (March 4th.)

DELHI.—March 17th. India Store Department. Oil-engine-driven generator sets with switchboard. (B.X. 3264.)*

Kettering.—March 23rd. Electricity Department. E.h.p. and l.p. armoured cables and one 1,000-kVA transformer. (March 4th.)

London.—BERMONDSEY.—March 16th. Board of Guardians. Six months' supply of electric lamps. Mr. H. H. Reeve, clerk to the Guardians, 283, Tooley Street, S.E.

ISLINGTON.—March 19th. Board of Guardians. Electrical supplies for 6 months. Mr. A. King, clerk, Guardians' Offices, St. John's Road, Upper Holloway, N.19.

Manchester. — March 18th. Electricity Committee. Three 500-kVA and two 250-kVA static transformers. (March 4th.)

Plympton St. Mary.—March 31st. Urban District Council. H.p. cables, underground and overhead mains, h.p. and l.p. switchgear, transformers and transformer kiosks. (See this issue.)

New Zealand. — WELLINGTON.—May 31st. Public Works Department. 50-kVA transformers for the Waikaremoana electric power scheme. (B.X. 3294.)* 50-kVA transformer for Arapuni scheme. (B.X. 3293.)*

June 7th. Railway sub-station equipment, Lake Coleridge electric power scheme. (B.X. 3295.)*

May 4th. General Post Office, Stores Division. Sub-station protectors. (B.X. 3286.)*

June 13th. New Zealand Railways. Machine tools, workshop equipment and overhead electric travelling cranes. (A.X. 4344.)*

June 6th. Six electric locomotives. (A.X. 4355.)* Overhead equipment for the Christchurch-Lyttelton electrification scheme. (B.X. 3301.)*

Oldham.—March 26th. Electricity Department. One 80-ton electric travelling crane. (March 4th.)

Rhondda.—March 26th. Electricity Department. Twelve months' supply a.c. ordinary and prepayment meters, mains and house service material. (February 25th.)

Roumania.—BUKAREST.—April 2nd. 600,000 porcelain insulators. (B.X. 3314.)*

Salford.—March 14th. Tramways Department. Electric lamps, steel tires, m.i. castings, &c. General Manager, 32, Blackfriars Street.

South Elmsall.—March 19th. Electric lighting installation at Westfield Lane Council School. Education Department, County Hall, Wakefield.

Southend-on-Sea.—April 9th. Light Railways and Electricity Department. Remote-controlled rotary convertors. (See this issue.)

Torquay.—March 16th. Electricity Department. One 6,000-kW turbo-alternator, with surface condenser and auxiliary plant. (February 25th.)

Tynemouth.—March 14th. Electricity Department. Three 250-kVA and one 500-kVA transformers. (March 4th.)

Walthamstow.—March 23rd. Electricity Department. L.p. cables and v.i.r. wires for 12 months. (See this issue.)

Warrington.—March 14th. Electricity Department. Motors and transformers. (February 25th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birkenhead.—Electricity Committee. Accepted:—
Cable (£6,800).—W. T. Henley's Telegraph Works Co., Ltd.; Macintosh Cable Co., Ltd. (£846).

Bury.—Town Council. Accepted:—
Boiler, stoker and economiser, Chamber Hall Power Station.—Clarke, Chapman & Co.
Electrically-driven pump for the baths.—Royles, Ltd.

Bradford.—Tramways Committee. Accepted:—
Ten miles of copper trolley wire (£922).—T. Bolton and Sons, Ltd.

Canterbury.—City Council. Accepted:—
Motor convertor (£2,591).—Bruce Peebles & Co., Ltd.
Feeder cables (£2,497).—Standard Telephones & Cables, Ltd.

Chelmsford.—Town Council. Accepted:—
Pumping installation at the swimming bath (£377), including an automatic motor float.—Electric Supply Corporation, Ltd.

Cheltenham.—Highways Committee. Accepted:—
Electric light fittings for 12 months.—Edison Swan Electric Co., Ltd.

Colchester.—Town Council. Accepted:—
Pipework at the new electricity station (£8,970).—J. Spencer, Ltd.

Dumfries.—Town Council. Accepted:—
Storage battery (£2,890).—D.P. Battery Co., Ltd.

Elvington, near Dover.—
Electric lighting of 102 houses.—Mr. Gordon C. Lent, Dover.

Glasgow.—Gas Committee. Recommended:—
Extension of electric cable from Tennant Street to Dalmarnock gasworks (£336).—A. Anderson & Co.
Special Acts Committee. Accepted:—
Electric light installation, St. Rollox Registration Offices—John Wright.

Tramways Committee. Accepted:—
D.c.c. wire.—Enfield Cable Works, Ltd.; British Insulated Cables, Ltd.; and W. T. Henley's Telegraph Works Co., Ltd.

Hitchin.—Rural Council. Accepted:—
Laying services on the Knebworth housing site, wiring houses and supplying and fixing fittings with five lights per house (£7 10s. per house, inclusive).—Stevenage Electric Light Co.

London.—LONDON COUNTY COUNCIL.—Education Committee. Installation of electric lighting at the trade school for girls in Barrett Street, Marylebone:—

E. Wender. (Recommended.)	**£947**
Alpha Manufacturing and Electrical Co., Ltd.	995
Anderson, Angell & Co.	1,062
J. F. Prendergast	1,095
L. G. Tate & Co., Ltd.	1,098
Alex. Hawkins & Sons	1,157
Richard Hunt & Co., Ltd.	1,167
J. Briggs & Co.	1,241
Pinching & Walton	1,362

Installation of electric lighting at Crondall Street school, Shoreditch:—

Bailey & Incledon, Ltd. (Recommended.)	**£480**
Anderson, Angell & Co.	529
Alpha Manufacturing & Electrical Co., Ltd. ...	550
A. Hawkins & Son	619
City Electrical Co.	623
Pinching & Walton	624
A. Meckhonik	637
L. G. Tate & Co., Ltd.	647
Smith & Hammond, Ltd.	655
Gaillard, Robinson & Co.	661
R. Hunt & Co., Ltd.	674
General Electrical Maintenance Co.	983

Electrical installation at the county secondary school, Eltham:—

Alpha Manufacturing and Electrical Co., Ltd. (Recommended.)	**£1,140**
Anderson, Angell & Co.	1,162
L. G. Tate & Co., Ltd.	1,250
E. E. Dyne	1,290
Alex. Hawkins & Sons	1,390
Woolwich Metropolitan Borough Council ...	1,687

GREAT WESTERN RAILWAY CO. Accepted:—
One 2-ton petrol-electric crane for Newport.—Ransomes and Rapier, Ltd.
Electrically-driven pumps for Landore.—F. Pearn and Co., Ltd.

ADMIRALTY.—
2-pint kettle hot plates.—Edison Swan Electric Co., Ltd.

ISLINGTON.—Borough Council. Accepted:—
Electric lamps for 12 months.—Edison Swan Electric Co., Ltd.

METROPOLITAN ASYLUMS BOARD.—Works Committee.
The following tenders were received for the installation of electric lighting at Millfields:—

South-Western Electrical Co.	£805
Alpha Mfg. & Electrical Co., Ltd.	835
Smith & Hammond, Ltd.	837
Read & Partners, Ltd.	881
A. Higginbotham & Sons	899
H. J. Galliers	937
R. Whipp & Co.	940
Sabine & Co.	1,047
T. Clarke & Co., Ltd.	1,050
C. J. Drake & Co.	1,078
Phillips & Dart	1,086
A. Dean & Co., Ltd.	1,099
J. Briggs & Co.	1,119
A. Cozens	1,144
Brightside Foundry & Engineering Co., Ltd.	1,200
C. F. Williams	1,237
Page & Miles, Ltd.	1,325
General Electrical Maintenance Co.	3,860

SOUTHERN RAILWAY.—
Six months' contract for electric lamps.—Metro-Vick Supplies, Ltd.

Manchester.—Electricity Committee. Accepted:—
Twelve months' supply of motor-starting switches.—Metropolitan-Vickers Electrical Co., Ltd.
Electric motors.—F. & A. Parkinson, Ltd.; Electromotors, Ltd.
450 street lanterns.—Cable Accessories Co., Ltd.
12,000 yd. 3-in. weldless-steel tubes.—British Mannesmann Tube Co., Ltd.; Bromford Tube Co., Ltd.
Circulating-water pumps.—Mather & Platt, Ltd.
L.p. circulating-water and steam pipes.—Aiton & Co., Ltd.
Four circulating-water pump suction valves.—J. Blakeborough & Sons, Ltd.

Northampton.—Northampton Corporation. Accepted:—
Electric wiring of Gipsy Lane housing estate (230 houses).—Lowke & Sons, Ltd.

Prestwick.—Ayrshire Education Committee. Accepted:—
Installing electric light at Prestwick school extensions (£242).—W. Ross, Ayr.

South Africa.—JOHANNESBURG.—Municipal Council. Accepted:—
8 miles 6,600-V cable (£12,838).—British Insulated Cables, Ltd.
½ mile ditto (£385).—British General Electric Co., Ltd.
—*S.A. Mining and Engineering Journal.*

South Shields.—Housing Committee. Recommended:—
Wiring 204 houses on the Cleadon Park estate (£5 14s. per non-parlour house, £6 4s. per parlour house, and £5 4s. per bungalow).—Moore & Oliver, Birtley.

Torquay.—Electricity Committee. Accepted:—
Railway siding and coal-handling plant at Newton Abbot power station (£19,500).—Ed. Bennis & Co., Ltd.
Six transformers (£613).—Hackbridge Cable Co., Ltd.

Wimbledon.—Electricity Committee. Accepted:—
Twenty-six 100-kVA transformers (£2,222) and six 200-kVA ditto (£730).—Hackbridge Electric Construction Co., Ltd. Two 500-kVA ditto (£628) and two 750-kVA ditto (£790).—Bruce Peebles & Co., Ltd. One 1,155-kVA ditto (£575).—British Electric Transformer Co., Ltd.
H.p. switchgear equipments (£2,000).—Brush Electrical Engineering Co., Ltd. L.p. ditto (£2,552).—G. Ellison.
Extensions to switchboards at generating station and two sub-stations (£3,867).—A. Reyrolle & Co., Ltd.

Health Committee. Recommended:—
Refrigerator at isolation hospital (£55).—Electrolux, Ltd.

Forthcoming Events.

Women's Engineering Society.—Friday, March 11th. 26, George Street, Hanover Square, W. 6.30 p.m. "The Electrification of Rural Districts." Dr. J. Purves.

Junior Institution of Engineers.—Friday, March 11th. 39, Victoria Street. 7.30 p.m. "Cupolas." Mr. J. Wolstenholme.

Birmingham Electric Club.—Friday, March 11th. Grosvenor Hotel. 7 p.m. Annual dinner.

Royal Society of Arts.—Monday, March 14th. 8 p.m. Cantor Lecture. "Some Industrial Applications of Electrothermics," by Mr. G. I. Finch.

Paisley Association of Electrical Engineers.—Tuesday, March 15th. Town Hall, Paisley. 7.30 p.m. "Apprentice Papers."

National Association of Supervising Electricians (Birmingham District Centre).—Tuesday, March 15th. Grand Hotel, Birmingham. 7.15 p.m. "Rotary Convertors." Mr. H. C. E. Jacoby.

Institution of Electrical Engineers.—Thursday, March 17th. London. 6 p.m. Faraday lecture, "What is Electricity?" Prof. W. M. Thornton.

London Students' Section.—Friday, March 18th. Imperial Hotel, Russell Square, W.C., 7.15 p.m. Annual dinner.

(North-Eastern Centre).—Monday, March 14th. Armstrong College, Newcastle-upon-Tyne. 7 p.m. "The Stability of Large Power Systems." Mr. F. H. Clough.

(Western Centre).—Monday, March 14th. Exeter. "Home Lighting." Mr. R. B. Mitchell.

(Sheffield Sub-Centre).—Wednesday, March 16th. Royal Victoria Hotel, Sheffield. 7.45 p.m. Address by the President, and smoking concert.

(South-Midland Centre (Wireless Section)).—Wednesday, March 16th. University, Birmingham. 7 p.m. "Characteristics of Audio-frequency Amplifiers used in Telephonic Repeaters." Mr. C. Robinson.

(South-Midland Students' Section).—Friday, March 18th. Annual joint meeting.

British Electrical Development Association.—Thursday, March 17th. Savoy Hotel. Annual dinner.
Friday, March 18th.—Royal Society of Arts. 7.30 p.m. "Refrigeration." Mr. N. E. Barber.

Edinburgh Electrical Society.—Thursday, March 17th. Royal Scottish Society of Art, 117, George Street. 8 p.m. "Ventilation." Mr. E. N. Beavis.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

Wire or strip suitable for the manufacture of thermal time lag devices.

Notes.

Late Legal.

WAREHAM ELECTRIC SUPPLY CO., LTD.—The petition of Mr. W. E. Weston for the compulsory winding up of this company again came before Mr. Justice Eve on March 8th; it was supported by creditors. The company asked for a further fortnight's adjournment, and this was granted.

Electrical Association for Women.

On February 25th, Metro-Vick Supplies, Ltd., entertained a party of the Birmingham Branch of the Electrical Association for Women, which visited the British Industries Fair. A demonstration of electric cooking and various types of electric domestic appliances was given, as well as a very interesting lecture by Mr. Edinborough, of the above company.

At the invitation of the British Thomson-Houston Co., Ltd., a party of the Manchester District Branch of the Association visited the company's King Street, Manchester, showrooms on March 4th, when an interesting programme included a demonstration of electric cookers and a short lecture on "How your house is wired," in addition to a demonstration of the "R.K." loud speaker and an exhibition of kinematograph films showing the making of the "Mazda" lamp.

The inaugural meeting for the formation of the South Wales and Monmouthshire Branch will be held at the City Hall, Cardiff, on Thursday, March 24th, at 6.30 p.m. The Lady Mayoress will preside.

Appointments Vacant.

Chief clerk (£400) for the Sunderland Electricity Department. Assistant mains engineer for the Bedford Corporation Electricity Department. Meter engineer for the Rangoon Electric Tramway and Supply Co., Ltd. Engineering assistant for the Borough of Wallasey Electricity Department. Electrical engineer to superintend overhead h.p. line erection for the Crediton U.D.C. (See our advertisement pages to-day.)

Artificial Light as an Aid to Aerial Navigation.

A paper on the above subject was read by Mr. H. N. Green (Royal Aircraft Establishment, Farnborough), at the meeting of the Illuminating Engineering Society on February 22nd. The first point considered was the location of the beacon. It was generally preferable to select a site on ground only slightly above the average level of the surrounding country, and to mount the beacon on a tower of sufficient height to clear ground mists. The chief features of such a light should be a distinctive character; it should be reliable in operation and require little attention, and should have a maximum range for a given power consumption.

Distinctiveness was, in practice, usually attained by flashing at regular intervals, the optical system rotating so that a series of beams rotated across the sky. This method was usually preferable to flashing the actual filament, for in the case of the very powerful gasfilled lamps used for this work, an appreciable time was required for the filament to cool. (This point was demonstrated by Mr. Green with the aid of one of the largest gasfilled projection lamps yet manufactured.) Distinctiveness might also be based on colour: the strontium beacon invented by Mr. Toulmin Smith and Capt. Davis utilised an oxy-acetylene flame, with an endless chain running through a bath of strontium chloride, which imparted a bright orange colour to the flame. It had, however, been replaced by the electric neon beacon which, besides having an unmistakable colour, could be flashed with great rapidity.

In the next section of the paper the author discussed the distribution of light and attainable beam-candlepower, after which the lighting of the Croydon-Lympne air-route was described. The neon beacon erected at Croydon utilised 8 kW at 5,500 V, and had a total horizontal candlepower of approxi-

mately 13,700. Flashing mechanism was included on the low-voltage side, and the beacon had a character consisting of a 2-second flash followed by a ½-second eclipse. The official range was given as 45 miles, but in clear weather the light had been seen by pilots from the French side of the channel.

The illumination of an aerodrome to facilitate landing was carried out with floodlight projectors, and Mr. Green presented a very striking photograph illustrating the effect produced. Another device illustrated was the arrangement of lights to form an arrow, giving to pilots information regarding the direction and strength of the wind. The paper concluded with an interesting discussion of the problem of flying during fog. Flying was not at present attempted when visibility was very bad, but there was always a chance of a pilot being caught in a fog. In this case he derived material assistance from the "leader cable" carrying a low-frequency alternating current, which marked out the route into the aerodrome. Once he could pick up the course of the cable by means of the instruments on the aeroplane he could safely guide himself to the landing ground, where he received the assistance of the special lights. The lights employed at Croydon for this purpose would probably consist of neon tubes at intervals down the landing course, suitably protected in cast-iron boxes embedded in concrete. When above the fog-level the pilot could often locate the landing place by the local illumination of the fog by the lights below.

Marconi Radio Apparatus.

The accompanying illustrations show two somewhat unusual forms of radio apparatus. Fig. 1 is a reproduction of a telegraph and telephone set for submarines; the power of the transmitter is 1.5 kW, and it has a c.w. telegraphy range of 300 miles and a telephony range of 100 miles. The valve to be seen in the panel on the left-hand side is the telephone modulator, and alterations in tuning are made by means of the plugs and sockets indicated at the top of the picture.

Fig. 1.—A Submarine Radio Set.

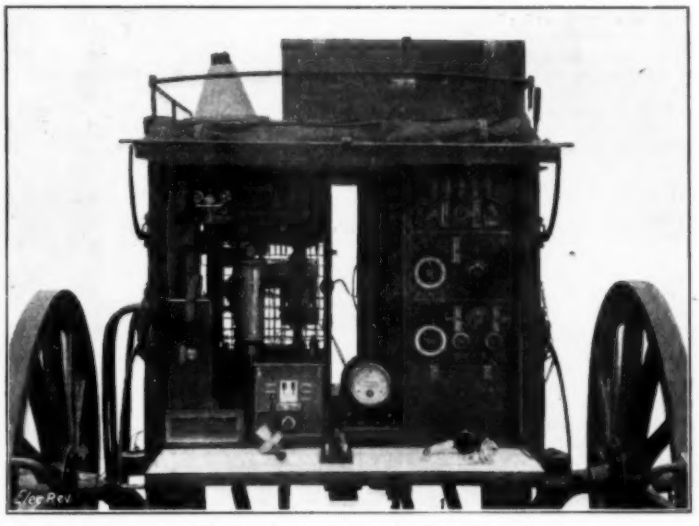


Fig. 2.—An Army Field Radio Outfit.

Fig. 2 also shows a combined set, which has a telephone range of 70 miles when 200-ft. high aerial masts are used, and a c.w. telegraph range of 200 miles. It is of the UC1 0.5-kW type, mounted on a cart for field use, the power for the transmitter being obtained from a generator driven by a petrol engine, which is usually carried on a second cart. The 5-valve receiver with two tuning units is on the right.

Arrangements are being made by Imperial Airways, Ltd., for the construction of new wireless stations to serve the Imperial air route to India, says *The Times*. The aeroplanes employed on the service will be within reach of Continental stations throughout their flight to Egypt, and the new stations are being erected between Cairo and Karachi to enable messages to be sent or received at any time during the journey. The aeroplanes are being fitted with the latest design of Marconi aircraft equipment of 150-watt telegraph and telephone transmitters and receivers, which will operate over a range of from 300 to 400 miles. A generator will be used which will give power for the navigation lights, the illumination of the cabins of the aeroplane, and the working of the wireless apparatus. In the event of a descent having to be made at an isolated spot it will be possible to communicate with one of the stations, as the aeroplane will have a battery charged by the wind-driven generator during flight, to meet such an emergency. There are already wireless stations along the route, but it is intended that those now being erected shall be of a more permanent character, and they are being equipped by the Marconi Company. Arrangements have been made through the Air Ministry for their erection, and when they are completed the chain of wireless stations from Egypt to India will be Heliopolis, Ismailia, Gaza, Rutbah Wells, Ramadi, Baghdad, Shaibah (Basra), Bushire, Bandar Abbas, Charbar, and Karachi.

A number of Antarctic whalers have been fitted this season with Marconi wireless-telephone apparatus, which has enabled them to spread further afield and to adopt tactics which would be impossible without this means of inter-communication; by means of a simple system of code words, the vital information in any message can be kept secret from any other ships that may be within range. The Marconi ¼-kW telephone sets fitted to all the ships of the Southern Whaling and Sealing Co., Ltd., and to other whaling fleets, have been specially designed for this class of work; they are operated by a stout lever which can be easily manipulated, even when the hands are heavily gloved, and the apparatus is enclosed in a steel case which renders it practically undamageable. Reception is by loud-speaker, so that there is no need to remove head coverings in order to use the telephone. One ship has heard another 2,000 miles away, but normally communication is maintained between whalers and with the whaling station at Stroemness, South Georgia, up to distances of 750 miles. In addition, a number of Antarctic whalers are this season fitted with Marconi direction-finders specially arranged for these small craft. In regions close to the magnetic pole, where much of the whaling is done, the wireless direction-finder, which is entirely independent of the earth's magnetism, has been found invaluable to the whaling vessels.

The Electricity (Supply) Act, 1926.

The "Memorandum on the Provisions of the Act," briefly mentioned in our last issue (H.M. Stationery Office, price 3d. net), has been prepared by the Electricity Commissioners for the information and assistance of authorised undertakers; it is in effect an abridged translation of the phraseology of the Act into plain language, grouping the various matters dealt with under appropriate headings, with marginal references to the scattered Sections from which the particulars are derived. By this means the provisions are brought into proper perspective, and a coherent impression of the powers, duties, and obligations of the Central Electricity Board, the owners of stations, authorised undertakers, joint electricity authorities, and power companies respectively can be readily obtained; but the Memorandum does not purport to give an interpretation of the provisions of the Act.

Anyone who is concerned with the working of the Act in any way, or who desires to make a quick survey of its contents, will do well to procure a copy of the pamphlet.

Educational.

NORTHAMPTON POLYTECHNIC INSTITUTE.—A course of four lectures on "Power Station Chemistry" will be given by Mr. W. S. Patterson on Friday evenings, commencing March 18th, at 7.15 p.m. Admission free. (See our advertisement pages to-day.)

The Raising of a Coal Bunker After Subsidence.

On Monday last a paper was read before the Society of Engineers (Inc.) by Mr. M. E. Gerard, M.Soc.C.E. (France), describing how a bunker, weighing 1,600 tons, and designed to hold 1,250 tons of coal, was raised to its original level, after a settlement of 7 ft. at one end, and was successfully reinstated upon new foundations. Temporary trestles of ferro-concrete were erected, from which to lift the structure by means of twenty-four 150-ton hydraulic jacks. An elaborate arrangement of packing was devised to enable the jacks to travel up step by step as the bunker was raised. Lifting proceeded according to a carefully arranged programme. A large number of men were engaged in the process—one man to each jack, and others to pack up under the bunker as it was raised. Each man had to be trained for his special work, and great discipline had to be observed during the operation. After the bunker had been raised to its original position the new founda-

tions were completed with new columns built up to meet the stumps of the old columns. The raised bunker has now been in full work for about three years.

Birmingham and Electricity Development.

The following appeared in the *Birmingham Post* of March 4th:—When the proposals for a unified electricity scheme were first outlined it was foreseen that a rigid application at the outset of a uniform periodicity must involve serious disturbance of trade in those districts where existing systems were not in accord with the chosen standard. The consensus of opinion was in favour of the 50 frequency which has been adopted in the larger proportion of undertakings under the independent development of the past. In the Birmingham area a 25 frequency applies, and it is stated by experts who are in the best position to judge, that to alter it at once to a 50 frequency would involve a direct outlay of millions of money and heavy losses through interruption of trade. It is evident that the representations made on this aspect of the Government's scheme have impressed those authorities who started with the premise that a uniform frequency was an indispensable principle, and who still hold that view.

The surrender of this position must not be inferred from the announcement made in Birmingham the other night that assent has been given to the perpetuation of the 25 frequency in the great generating station at Hams Hall which Birmingham is about to add to its equipment. The Electricity Commissioners have their hands too full with the problem of development in other parts of the Kingdom to give attention to the Midlands yet awhile. Far-sighted plans have been made in Birmingham, for the progress of the electrification of industry and other services. If the rate of development is to be maintained, the equipment of the Hams Hall station must be put in hand forthwith, or the municipality will find itself without adequate resources for the prosecution of its plans within the next year or two. It is in these circumstances that assent has been given to the installation of plant being proceeded with. No decision has been arrived at with regard to the larger question of unification. As has been pointed out before, there is no imperative reason why differential frequencies should not still exist side by side as they have in the past. If unification is the ultimate aim, the conversion to standard of those local systems which do not now conform to it may be accomplished at far less expense and inconvenience as existing plants reach the end of their economic life. The equipment of Hams Hall and its connections on a 25 periodicity would not conflict with such a policy, and this consideration has probably carried a good deal of weight with the central authority.

The Birmingham electricity supply is now stretching out into the coalfield across the north-eastern borders of the municipality. A seven miles line carries the current to the new pit, which is to be sunk at Hurley. In co-operating in the work of colliery development the department has entered upon a new and pregnant sphere.

National Institute of Industrial Psychology.

The annual report of this Institute for the year 1926 was presented at the annual meeting of members on Wednesday last week; it shows an increased revenue from investigations, and an increase of membership from 665 to 984—49 per cent. In every direction the activities of the Institute have expanded to an unprecedented degree. Twenty-two investigations for private firms were carried out, besides many shorter surveys, with great satisfaction to the clients, as well as to their employés, who cordially recognise the benefits that they derive from the work. The rapidly growing demands on the educational and clerical work of the Institute have necessitated an addition to the staff of 25 per cent., and increased accommodation is urgently needed. Many instances of increased output, economy of space, and improved working conditions in factories and offices are cited, resulting from the Institute's recommendations. New tests in connection with vocational selection have been devised, and favourable reports have been received. An experiment in vocational guidance which has been in progress for some years has been continued, and 600 children have been examined and advised as to the work they are fitted for; many of these cases have been followed up, to observe the results, which have proved very satisfactory. Various special researches are also in progress. The income was £11,519, and the expenditure £11,399. The appeal fund amounted to £18,054, and donations and subscriptions to £2,571.

Institute of Wireless Technology.

At the February meeting of the Institute a paper entitled "A New Loud-speaker" was read by Mr. H. W. Gambrell, A.M.I.E.E., and was followed by a demonstration of the R-K loud-speaker; reproduction was of very high quality, particularly in the lower frequencies, and it was obvious that this instrument was a great advance in loud-speaker design.

Royal Institution.

On Tuesday, March 15th, at 5.15 p.m., Dr. G. Shearer begins a course of two lectures on "X-rays and the Chemical Molecule"; on Thursday, March 17th, at the same hour, Dr. Guild delivers the first of two lectures on "Colour Measurement"; and on Saturday, March 19th, at three o'clock, Sir Ernest Rutherford will commence a course of four lectures on the "Alpha Rays and Atomic Structure." The Friday evening discourse on March 25th will be delivered by Dr. C. T. R. Wilson on "Thunderclouds."

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The staff of the Sun Electrical Co., Ltd., and a number of guests, met at a dinner at the Hotel Cecil on Friday last to celebrate the completion of 25 years in a managerial capacity by Mr. A. G. BEAVER. Mr. J. J. Rawlings (director) presided in the absence, through ill-health, of the chairman (Mr. R. Tweedy Smith), and read a letter from the latter expressing his great regret at being unable to attend. In proposing the health of the guest of the evening, Mr. Rawlings said that Mr. Beaver joined the Sun Company at its inception 28 years ago, being appointed general manager in 1902. In 1921 he was made managing director, a position which he still held. The speaker paid a tribute to Mr. Beaver's energy, consistency, and calmness, which had brought the company to its present proud position in the electrical industry. He made special reference to Mr. Beaver's activities in Association work. As a token of his co-directors' esteem, he asked Mr. Beaver to

L. C. Smith.] [*London*

Mr. A. G. Beaver.
Managing Director of the Sun Electrical Co., Ltd.

accept an inscribed gold cigarette case for himself and a travelling bag for Mrs. Beaver. Replying to the toast, Mr. Beaver said that during the period in which he had been with the company he had received loyal support from his fellow directors and the whole of the staff. He held that the way to succeed in business was to enjoy it, and he had enjoyed every moment of his time with the Sun Company. There were few directorates which had remained the same so long as that of the company. In a humorous speech, Mr. W. R. Rawlings (director) proposed the toast of the company and conducted his listeners upon an imaginary tour of the premises. The health of "The Staff" was proposed by Mr. Beaver, who said that no one could deal with such a toast with better knowledge than himself. He referred to the long service of many of the staff and paid special tribute to the work of the secretary (Mr. W. J. Rogers), Miss Dewdney, Miss Tickner, and Mr. Weeks. He then made presentations to Messrs. Weeks, Rogers, and Owen, and Miss Tickner, in recognition of their 21 years' service with the company. A special, personal, presentation was made to Miss Dewdney, Mr. Beaver's secretary. Brief acknowledgments were made by the recipients, Mr. Rogers, Junr., replying for his father, who was absent through ill-health. The toast was replied to by Mr. D. M. Fraser, manager of the Leeds branch of the company. After the speeches there was a dance, which the 200 or so guests thoroughly enjoyed.

At a recent meeting of the Blackburn Town Council, it was stated that the electrical engineer (Mr. P. P. WHEELWRIGHT) had asked for a re-consideration of his salary. The Town Clerk was instructed to obtain copies of a return from other electricity undertakings, together with copies of the statistical report on salaries paid to electrical engineers, for consideration at a special meeting.

The Southport Town Council has adopted a recommendation by the Electricity Committee to pay the electrical engineer (Mr. E. MOXON) a salary of £1,550 a year as from April 1st next.

On the unanimous recommendation of the Electricity Committee the Southport Town Council, at a meeting held on March 1st, appointed Mr. W. T. GANN to the position of deputy borough electrical engineer.

A recommendation that the salary of Mr. SEDDON, engineer and manager of the Edinburgh electricity department, should be increased from £1,200 to £1,300, was lost by 31 votes to 25, at a Town Council meeting last week.

The Dover Town Council has increased the salary of Mr. E. H. BOND, general manager of the tramways, from £400 to £425 per annum, as from April 1st next.

Mr. H. A. UTTLEY, M.Sc., M.Inst.C.E., has been appointed resident civil engineer for the Barton Station extensions of the Manchester Electricity Department, in place of Mr. D. E. Laing, who has resigned. Mr. A. HEATON, of the Finance Staff, has been appointed assistant financial controller to fill the vacancy caused by the death of Mr. B. Bennison.

Mr. W. T. TALLENT-BATEMAN having accepted the position of manager for South Africa for Messrs. Ferguson, Pailin, Ltd., left Bombay in December last, where, for the last three years he has been manager for India, Burma, and Ceylon for the company. His address in future will be: c/o Messrs. Ferguson, Pailin, Ltd., P.O. Box 737, Liberal Life Building, Burg Street, Cape Town.

In appreciation of his 25 years' service as manager of the Cheltenham and District Light Railway Co., Mr. H. J. MCCORMICK was recently presented by some of the leading townspeople with a silver gilt loving cup. The presentation was made by the Mayor (Ald. C. H. Margrett), who also presented a turquoise cross to Mrs. McCormick.

Mr. F. W. PURSE, borough electrical engineer of West Ham, has been elected president of the West Ham Rotary Club for the ensuing year.

Mr. P. K. TURNER, head of the Research Department of Burndept Wireless, Ltd., is joining Messrs. Alfred Graham, Ltd., makers of the well-known "Amplion" loud-speaker, as assistant chief engineer. Mr. Turner made his acquaintance with "wireless" in 1911, with Mr. H. Grindell Matthews, and in 1913 he owned, and gave instruction in, the "Irish School of Wireless" in Dublin. During the war he was a wireless officer in the R.F.C. and the R.A.F., arriving at the head of No. 2 Wireless School; afterwards he joined Messrs. Iliffe and Sons, and was editor of the *Wireless Trader*, and of *Experimental Wireless*, until he went to Burndept's in December, 1925.

Obituary.—SENOR M. P. SANTANO.—The death is reported from Madrid of Señor Don Miguel Perez Santano, a well-known Spanish telegraph engineer, and the inventor of many improvements in telegraphy.

MR. W. LEAF.—We regret to record the death of Mr. Walter Leaf, who, in addition to his position of pre-eminence in the banking and business world, was prominently associated with London electricity supply companies. For many years he was chairman of the St. James' and Pall Mall Electric Light Co., Ltd., and deputy chairman of the Central Electric Supply Co., Ltd. He was also a director of the London Power Co. He was 75 years of age.

MR. A. F. HILLS.—The death of Mr. Arnold Frank Hills, of Thames Ironworks and Shipbuilding fame, in his seventieth year is an event which revives many memories of days gone by in the engineering and shipbuilding world. We know of no more striking example in the industrial world of the "triumph of mind over matter," as *The Times* describes the remarkable way in which he overcame his physical disabilities. In his University days he was a notable athlete, but later a serious illness left him "a hopeless cripple, tied to his bed-chair, unable to move a limb without help." Yet though permanently in this state of physical helplessness, his mind remained vigorous and active, and he devoted his thought to the affairs of the business, its serious problems, the well-being of the company's employés, and so on. He struggled hard to continue the activities of the Thames Ironworks Co., and for some years an electrical manufacturing department was conducted, but eventually he had to close the works down. He was a man of strong convictions and original and independent in his attitude towards industrial problems—he was one of the first to try profit sharing—but we name him here especially for the gallant struggle that he made and for the example of fortitude that should be an inspiration to others who chafe under far less serious disabilities.

MR. A. E. COTTERELL.—The death occurred on March 3rd of Mr. Arthur E. Cotterell, of 34, Manorway, Beckenham, who was until his retirement assistant provincial superintendent for the Midlands of the National Telephone Co. He was in his 62nd year.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies. Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Hertfordshire Rubber Co., Ltd.—Private company. Registered March 3rd. Capital, £15,000 in £1 shares. Objects: To carry on the business of manufacturers of or dealers in rubber and rubber goods and products, rubber substitutes, waste rubber, ebonite, vulcanite and any other plastic substances or compounds made therefrom, &c. The subscribers (each with one share) are:—Joan Peachey, 9, Hetley House, Hetley Road, W.12, stenographer; V. Deighton, 97, Junction Road, Highgate, N.19, solicitor's clerk. The first directors are J. Entwistle (permanent) and others to be appointed by the subscribers. Qualification of first directors, 1 share; of other directors, 250 shares. Solicitors: Arthur Blackman, Hailey & Co., Capel House, New Broad Street, E.C.2.

H. J. Bartlett (Hove), Ltd.—Private company. Registered March 2nd. Capital, £2,000 in £1 shares. Objects: To acquire the business of an electrical engineer and contractor now carried on by H. J. Bartlett at 12, Cross Street, Hove. The permanent directors are:—H. J. Bartlett, 12, Cross Street, Hove; E. L. B C. G. Whitcher, 58, Lansdowne Place, Hove. Qualification, 100 shares. Remuneration as fixed by the company. Manager: H. J. Bartlett. Solicitors: Cockburn, Gostling & Co., 61, Church Road, Hove.

Light-o'-Day Electric Lamp Co. (1927), Ltd.—Private company. Registered March 1st. Capital, £5,000 in 2,000 participating preference shares of £1 and 60,000 ordinary shares of 1s. each. Objects: To acquire the business of applying to electric lamps a lac known as "Oriona Lac," and to adopt an agreement with C. H. Stone. The subscribers (each with one ordinary share) are:—G. E. Byers, 318a, Euston Road, N.W.1, consulting mining engineer; F. H. Edwards, 76, Cheapside, E.C., solicitor. The first directors are:—G. E. Byers, F. H. Edwards, R. P. Wilson, S. Crowther-Smith, and A. C. Peebles. Qualification, £100. Remuneration, £50 each per annum and 7½ per cent. of the net profits in any year after paying the fixed preference dividend of 10 per cent., divided between them. Solicitor: F. Harold Edwards, 76, Cheapside, E.C.2. Registered office: 318a, Euston Road, N.W.1.

Vacuum Lamp Co., Ltd.—Private company. Registered March 3rd. Capital, £500 in £1 shares. Objects: To carry on the business of importers and exporters of and dealers in electric lamps, and wireless and electrical accessories. The first directors are:—Paula Weinmann (Russian, of English origin) and David Weinmann (Swiss), 285, Old Street, E.C. Qualification, 50 shares. Solicitor: V. A. Lyons, 16-17, Devonshire Square, E.C. Registered office: 285, Old Street, E.C.

Transporting Machinery and Engineering Co., Ltd.—Private company. Registered March 3rd. Capital, £25,000 in £1 shares. Objects: To carry on the business of mechanical, electrical, civil, marine, motor and general engineers, contractors, designers and manufacturers of labour-saving and other machinery and appliances, &c. The subscribers (each with one share) are:—S. J. Sulston, 32, Deal Road, S.W.17, incorporated secretary; R. Keedwell, 51, Stembridge Road, Anerley, S.E.20, law clerk. The first directors are not named. Solicitors: Churchill, Clapham & Co., 1, Broad Street Place, E.C. Registered office: Stanley House, Dean Stanley Street, Westminster, S.W.1.

North-Western Wireless Company and Wallasey Motor Exchange, Ltd.—Private company. Registered March 3rd. Capital, £2,500 in £1 shares (1,250 7½ per cent. cumulative preference and 1,250 ordinary). Objects: To acquire the business of radio engineers and manufacturers and motor dealers now carried on by J. H. Guest Cochran at 18, Rullerton Road, Wallasey, as the "North-Western Wireless Company and Wallasey Motor Exchange." The first directors are:—J. H. G. Cochran (permanent), 14, Rullerton Road, Wallasey, Ches.; W. C. Davis, 14, Rullerton Road, Wallasey, Ches. The said J. H. G. Cochran shall be managing director and chairman so long as he holds 100 ordinary shares. Qualification of directors, £1. Remuneration as fixed by the company. Registered office: 18, Rullerton Road, Wallasey, Ches.

Express Magneto (Repairs) and Electrical Co., Ltd.—Private company. Registered March 3rd. Capital, £2,000 in 500 ordinary and 1,500 6 per cent. cumulative preference shares of £1 each. Objects: To acquire the business carried on at Goldcroft, Yeovil, Somerset, as the "Express Magneto" (Repairs) and Electrical Company," and to carry on the business of electrical, wireless and general engineers, manufacturers and repairers of and dealers in electrical and radio apparatus, motors, motor cycles, &c. The first directors are:—J. J. Davis, Milborne Port, Somerset; L. G. Wheeler, Rose Cottage, Yeovil Marsh, Somerset; A. C. Balchin, West Coker Road, Yeovil, Somerset (all permanent, subject to each holding £100 shares). Secretary: A. H. W. Chinnock. Solicitor: A. King, Westminster Bank Chambers, Bridgwater, Somerset. Registered office: Goldcroft, Yeovil, Somerset.

Flexible Electric Cords, Ltd.—Private company. Registered February 24th. Capital £1,000 in £1 shares. To carry on the business of electrical engineers, manufacturers of wireless cables, and other apparatus connected with wireless telegraphy, manufacturers of, agents for and dealers in flexible electric cords, electric wire manufacturers, &c. The first directors are:—C. V. Matthews, 172a, Lea Road, Wolverhampton, solicitor; F. Kniveton, Astley House, 138, Southbury Road, Enfield Town, N., electrical engineer. Qualification, one share. Solicitor: C. V. Matthews, 172a, Lea Road, Wolverhampton. Registered office: Queensway, Ponders End, Middlesex.

Anderson & Stuart, Ltd.—Private company. Registered February 25th. Capital £1,000 in 250 10 per cent. preference and 750 ordinary shares of £1 each. Objects: To carry on the business of installers and suppliers of materials, apparatus and appliances for wireless telephonic, telegraphic and other telephonic, electrical, magnetic, galvanic, mechanical, and other apparatus and appliances, &c. The permanent directors are:—G. A. Anderson (chairman), 31, Greencroft Gardens, Hampstead, N.W.6 (director and secretary of Gil-Ray Trading Corporation, Ltd.); Eleanor M. Stuart, 21, Milton Road, Weston-super-Mare, Somerset; A. C. Gilmour, 42, Bacon Lane, Roe Green, Kingsbury, N.W.9 (director of Gil-Ray Trading Corporation, Ltd.). Qualification, £50 shares. Secretary: A. C. Gilmour. Solicitors: Baxter & Co., 12, Victoria Street, S.W.1. Registered office: Sicilian House, Sicilian Avenue, W.C.1.

Gillan Radio-Electric, Ltd.—Private company. Registered February 28th. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers of and wholesale and retail dealers in wireless apparatus and component parts, &c. The first directors are:—W. Greenwood, 40, Hertford Avenue, East Sheen, Surrey; Mrs. Janet M. Greenwood, 40, Hertford Avenue, East Sheen, Surrey. Qualification, £10 shares. Solicitors and registered office: Reid, Sharman & Co., 36, Bedford Row, W.C.1.

Amalgamated Lamp Companies (Great Britain), Ltd.—Private company. Registered February 28th. Capital, £600 in £1 shares (300 5 per cent. cumulative preference and 300 ordinary). Objects: To carry on business as agents and factors for electrical equipment and similar goods, &c. The directors are:—Miss G. M. Cuthbert, 85, Alexandra Road, Hampstead, N.W.8; H. Feneron, Rosslyn, Wraysbury Road, Staines, electrical agent (both permanent, subject to each holding 300 preference or ordinary shares). Solicitor: E. V. Miles, 30, Theobalds Road, Bedford Row, W.C. Registered office: 14, Moorgate Chambers, Finsbury Pavement, E.C.2.

Midways Electric, Ltd.—Private company. Registered February 28th. Capital, £500 in 400 7 per cent. cumulative preference and 100 ordinary shares of £1 each. Objects: To acquire the business of electrical engineers and contractors now carried on by W. E. Burton as "Midways Electric," at 10, Gees Court, Oxford Street, W. The subscribers (each with one share) are:—G. T. Heard, 23, Harewood Road, Colliers Wood, S.W.19, solicitor's managing clerk; F. G. Buckland, 49, Lavender Avenue, Mitcham, Surrey, solicitor's clerk. The directors are: W. E. Burton and R. P. Atwood. Solicitors: Perowne & Co., 7, Great James Street, W.C.1.

Takato & Co., Ltd.—Particulars of this company were filed on March 1st. The capital is 3,000,000 yen in 50-yen shares. The company was incorporated in Tokio on July 26th, 1925, to carry on the business of sellers, agents, and transporters of electrical, steam, hydraulic, gas and oil machinery, apparatus and instruments, iron, steel, and all other metals, &c. The British address is 282, Dashwood House, 69, Old Broad Street, E.C., where R. H. Webb and A. E. Danvers are authorised to accept service of process and notices on behalf of the company.

Official Returns of Electrical Companies.

Neutron, Ltd.—H. Hackett, 448, Strand, W.C.2, ceased to act as receiver or manager on February 21st, 1927.

Re-Echo Radio Co., Ltd.—C. H. Whatley, 6-7, Charing Cross Chambers, Duke Street, Adelphi, W.C.2, ceased to act as receiver or manager on February 21st, 1927.

Eunice Wireless Cabinet Works, Ltd.—Issue on February 21st, 1927, of £200 debentures, part of a series.

Cark and District Electricity Co., Ltd.—Particulars filed of £1,000 debentures authorised February 4th, 1927, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Newton Brothers (Derby), Ltd.—Particulars filed of £75,000 debentures authorised January 1st and covered by trust deed dated February 14th, 1927, charged on land and buildings in Alfreton Road, Derby, and fixed plant and the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £30,000. Trustees: Midland Bank Executor and Trustee Co., Ltd.

Cleveland and Durham Electric Power, Ltd.—Satisfaction to the extent of £11,300 on various dates between February 4th, 1926, and February 19th, 1927, of debentures secured by trust deed dated October 6th, 1913, and supplemental trust deed dated December 31st, 1918, securing £250,000.

Radio Accessories, Ltd.—Debenture dated February 10th, 1927, to secure all sums of money as may be owing to the chargees on June 30th, 1929, or on such earlier date as the principal moneys become due under the debentures on the balance of the company's loan and current account with the chargees or in respect of loan and current accounts due by the company to such chargees or in any other manner whatsoever, charged on the company's undertaking and property, present and future, including any uncalled capital. Holders: Burndept Wireless, Ltd., Eastnor House, Blackheath, S.E.3.

Attaix, Ltd.—Satisfaction in full on February 1st, 1927, of debentures dated February 10th and July 2nd, 1926, each securing all moneys not exceeding £500.

S. Kalisky (Aldgate), Ltd.—Debenture dated February 1st, 1927, to secure £4,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: S. Kalisky, Ltd., 43, Bidder Street, E.

Nox Electric Lamp Co., Ltd. (189,377).—Capital, £2,000 in £1 shares. Return dated December 31st, 1926. 502 shares taken up. £2 paid. £500 considered as paid. Mortgages and charges: Debenture for £662 13s. 4d.

Walker, MacEwen & Co., Ltd.—E. L. Holford, of 41, Nightingale Lane, Wanstead, E.11, ceased to act as receiver on February 8th, 1927.

City Notes.

Marconi's Wireless Telegraph Co., Ltd.

The report of the committee appointed to investigate the company's affairs was issued last week. The directors' report for 1926 was published a day or two later, and as this embraces the committee's recommendations, it will be sufficient to deal with the directors' statement. It is shown that although over £3,000,000 was taken from reserves in 1923 and 1924 for the purpose of writing down sundry assets, it was found in May last year that further heavy writing down was necessary. To ensure that this operation would be final, Sir Gilbert Garnsey and the company's auditors, Messrs. Cooper Bros. & Co., were asked to investigate the company's affairs. Their report shows that after taking into account the trading profit, less the preference dividend, for 1925, additional provisions should be made to the extent of £2,766,168 in respect of:—Advances to associated companies, which have become bad (£1,059,623); writing down of share holdings in associated companies (£772,623); obsolescence of plant due to the adoption of the "beam" system (£373,856); further reserve to meet depreciation of the company's holdings in foreign currencies, &c. (£275,690); and provision for claims and expenses arising out of the Argentine law suit (£237,955). Following these recommendations, the directors have decided to write down patents and patent rights to £1, and to transfer the balance to general reserve. After transferring the balance of the general reserve and the credit balance from 1924, making

together £1,140,374, there remains a deficiency of £1,625,794. Following the Committee's advice, the directors have decided to recommend a reduction of 10s. per share in the ordinary capital (i.e., from £2,374,954 to £1,187,477). The capital will subsequently be restored to £4,000,000 by the creation of 3,250,092 new shares of 10s. each. If these recommendations are approved, the directors will be able to recommend a dividend out of the profits of 1926 when the accounts are available. During the last two years the policy of the management has been to wind up all non-wireless companies which had no reasonable chance of earning profits; to reorganise those companies which had profit-earning possibilities with a view to their disposal; to concentrate the manufacture and sale of broadcasting material in one company; to construct "beam" stations and modernise existing stations; to secure from the Government a general licence to establish telegraph services throughout the world; and to improve relations with Government departments. At the beginning of 1925 the company had interests in 56 other companies. Twelve of these had no connection with the wireless business, and nine of them have been liquidated, while the other three have been reorganised for disposal, and are either making a small profit or balancing their accounts. Five other companies were dormant, and have since been wound up. Three companies making broadcasting apparatus have been amalgamated, and last year made a substantial profit. The company's claim against the Government for the use of patents during the war has not yet been settled; progress has been made in arbitration regarding this matter. During the past four years the company's net revenue from patent royalties has shown a satisfactory increase. The "beam" system is being continually improved and developed. The Canadian station has been handed over; the Australian station has passed tests satisfactorily; and it is hoped to open the South African and Indian services during the next three months, and the North and South American services during the coming summer. These services should all prove remunerative to the company. The report proceeds to review other developments, and mentions the formation of an Egyptian subsidiary to conduct radiotelegraphic services between Egypt and other countries; the inauguration of further services by the Portuguese company; the contract for the administration by the company of the Peruvian postal and telegraphic services; a similar arrangement in Bolivia; a contract for the erection of radio stations in Venezuela; and the development of a system of *fac simile* transmission. Improvement in the company's relations with Government departments is reported, and mention is made of the general licence received in 1925 to establish services with all extra-European countries and Austria, Bulgaria, Denmark, Finland, Greece, Portugal, Russia, Spain, Sweden, Switzerland, Turkey and Jugo-Slavia. Senatore Marconi has expressed a desire to be relieved of his work as chairman of the company to permit him to devote more time to the technical side. It is accordingly proposed to accede to this desire, and to appoint Senatore Marconi president of the company. The following gentlemen have been invited to join the board:—Lord Inverforth, P.C., Major-General Sir Frederick Sykes, G.B.E., M.P., Lord Wester Wemyss, G.C.B., Sir Charles C. Barrie, K.B.E., and Mr. F. R. S. Balfour, D.L., and it is suggested that Lord St. Davids shall be appointed chairman. The following directors have intimated their willingness to resign:—Mr. H. W. Allen, Sir Frederick J. Barthorpe, Lord Herschell, Sir Wm. Slingo, and Mr. S. St. J. Steadman. The necessary resolutions for the reduction and subsequent increase of the capital and for the appointment of Senatore Marconi as president will be submitted at the annual meeting to be held on March 15th.

The directors point out that although the authorised capital is to be raised to £4,000,000, there is no intention of making any new issue until the development of the company's business warrants it.

Midland Counties Electric Supply Co., Ltd.

The annual meeting was held on March 1st. Mr. G. Balfour, M.P. (chairman), who presided, said that when they reviewed the difficulties with which they were faced during the year, in common with all concerned with public services, they could be satisfied with the results that had been obtained. The aggregate number of miles run by the tramway cars and motor-'buses during the year was practically the same as in the previous year, but the number of passengers decreased, some unremunerative services having been cancelled. Better results would be obtained if only a reasonable number of vehicles were allowed to run; the public would still be properly catered for, and the business would be remunerative. They hoped by degrees to make the transport branch a paying one; it represented about 12 per cent. of the company's resources. In the supply of electricity steady progress had been maintained, although full benefit had been denied them on account of the industrial troubles. The amount of energy sold had increased by 22 per cent. to 73,565,000 kWh, and 2,709 consumers had been added, making a total of 11,366. The connected load of the various operating companies had increased by 13,480 kW to 67,720 kW; the maximum load had risen to 28,640 kW. Arrangements were being made for the installation of another 12,000-kW turbo-alternator with the necessary boiler plant, &c., at the Spondon station, and additional boiler plant at the Avon station. In a few months the work of connecting the Avon, Hinckley and Spondon stations by 33,000-V lines would be completed. The lines would be in duplicate and 53 miles long. During the year 92 miles of h.p. lines and 64 miles of l.p. cables had been installed, making the respective totals 430 and 250 miles. Supplies of electricity were inaugurated in three urban districts and 19 parishes during the year and bulk supplies to Coventry, Mansfield and Newark were commenced. The company was now supplying in three boroughs, 22 urban districts, and 50 parishes in rural districts, in addition to bulk supplies to five local authorities. The Leicestershire and Warwickshire Company's Bill received the Royal Assent in June last, and Special Orders were obtained by the Derbyshire and Notts. Company for Shardlow and Bakewell. A Special Order was also obtained by the Leamington and Warwick Electrical Co. for the areas south of Warwick. As soon as lines were extended Special Orders were applied for, and four applications were now being considered. Mr. Balfour expressed the company's intention to do what it could to facilitate the operation of the new Electricity (Supply) Act. He doubted whether the Act would effect the anticipated economy; it was not its effect upon the companies but upon the public and the policy involved, which he believed to be wrong. After referring to the success of the issue of preference shares during the year, he said that the results during the first two months of the current year had justified their best expectations.

London and Suburban Traction Co., Ltd.

The annual meeting was held last week, Lord Ashfield (chairman) presiding. In presenting the report (*vide* our last issue, p. 356), the chairman pointed out that the company's income was derived from three sources—tramways, motor-omnibuses, and electricity supply. Although their tramway investments at £1,658,000 represented 75 per cent. of the whole, they had received nothing from that source for 1926. Until the tramways could be restored to a state of moderate prosperity, the shareholders were not likely to receive a return upon their investments. The traffic receipts of the combined tramways had fallen by £20,000. The Metropolitan Electric Tramways failed, by £3,844, to meet its bare working expenses. The company's lease expired in 1930, and it had intimated to the Middlesex County Council that unless there was a drastic change in the circumstances under which tramways operated it could not entertain a renewal of the lease. Since 1922 the competition of motor-'buses had increased by 437 per cent. He (the chairman) hoped that before the expiry of the lease practical steps would have been taken to relieve the tramways of that wasteful and injurious competition. Such improvements as there were during the year occurred on the Uxbridge Road route of the London United Tramways system and the development of housing in the area served by the South Metropolitan Electric Tramways. The Ministry of Transport had restricted the number of omnibuses on the Uxbridge Road, and the L.U.T. had consequently been able to improve its stock and provide a good service for the public, which was duly appreciated. By the adoption of similar methods on other routes, both the companies and the public would secure advantages. The tramways laboured under onerous burdens which should be shared by their competitors. If the Government honoured its pledge to relieve the tramways from wasteful and uneconomic competition he had no doubt that they would again achieve prosperity. The report and accounts were adopted.

Scottish Power Co., Ltd.

The annual meeting was held in Edinburgh on February 28th. Mr. G. Balfour, M.P., who presided, said that the trading results for the past year were satisfactory in view of the circumstances. For the first four months of the year the demand showed a 10 per cent. increase, but then the coal dispute supervened. Their total receipts had nevertheless risen from £117,332 to £133,184; that result was due partly to normal progress in domestic and small power supplies, and to a greater degree to temporary arrangements with collieries for supplies. The operating costs were substantially increased, but owing to their policy of early securing options upon colliery stocks, they had not had to fall back on foreign coal, which was inferior and high-priced. The nature and extent of the company's load, apart from normal expansion, justified their confidence that the improvement in trade which was anticipated would immediately be reflected in the trading results. A Special Order had been obtained during the year, and the company was therefore now able to give lighting as well as power supplies throughout the whole area, with the exception of one or two small burghs which already had their own undertakings. Arrangements had been made to link up with the Fife Electric Power Co., and the construction of the trunk line was now proceeding and would be completed shortly. The company had made similar arrangements with the Grampian Co. The purchase for £93,860 of the Alloa undertaking by the Scottish Central Co. would prove a satisfactory addition to the company's assets. An issue of capital was to be made to repay the money borrowed for this and other purposes. As the authorised capital was already fully issued, the shareholders would be asked later in the year to sanction an increase. The chairman made brief reference to the Electricity (Supply) Act, 1926, and then reviewed the financial results, which were summarised in our issue of February 25th (p. 313).

North Metropolitan Electric Power Supply Co.

Presiding at the annual meeting last week, Sir James Devonshire, K.B.E. (chairman) said that the company, to a considerable extent, had escaped the effects of the industrial depression, although the output and revenue had been affected. No increase had been made in the charges to their 30,000 domestic consumers on account of the coal dispute. Other matters which had an effect upon the revenue, as compared with 1925, were the closing of the British Empire Exhibition and the reduction of the rates for energy supplied to the Metropolitan Electric Tramways. Notwithstanding this, the same dividend had been paid upon a larger capital. The total expenditure of the company had been brought to £3,100,000 by the expenditure during the year of over £500,000, chiefly upon mains and sub-stations. The demand for electricity from the public was as great as ever, but it was small at present compared with what it would become in the near future when electricity was adopted for all domestic purposes. Already there was a tendency in that direction, and that would be encouraged by a method of charge consisting of a fixed rate to cover standing charges combined with a low "unit" rate. Although the balance from working was £25,000 lower, they had been able to declare the same dividends and carry an increased amount forward. Referring to the construction of the Brimsdown station, the chairman said that the initial installation would consist of two 25,000-kW sets, but the ultimate capacity would be 150,000 kW. During the construction period the debenture interest would be paid by the Construction Company out of revenue. As soon as the station commenced operation a rental would be paid by the Power Company to the Construction Company, and this would, generally speaking, meet the latter's debenture interest and sinking fund. The report and accounts were approved.

Underground Electric Railways Co. of London, Ltd.

The report for the year ended December 31st last shows traffic receipts amounting to £804,113, to which are added miscellaneous receipts of £5,975, making £810,088—an increase of £69,643, as compared with 1925. The net receipts at £719,301 were £71,235 higher. After deducting interest and adding £145,959 brought forward there was a balance of £241,054. From this £8,929 is deducted for the payment of 8,929 ordinary shares in accordance with the scheme for the reorganisation of the capital, and the cost of this scheme, £11,000, leaving £221,125. It is proposed to pay a dividend of 1¼ per cent. on the ordinary shares, which will leave £145,092 to be carried forward. Reference is made to the reorganisation, and it is noted that the capital of the company now consists of 5,068,878 ordinary shares of £1 each. The investments were increased during the year by purchases of London General Omnibus and North Metropolitan ordinary shares. The results of the subsidiary companies are reviewed (*vide* ELECTRICAL REVIEW, February 25th, p. 311), and the deaths of Lord Stuart of Wortley, and the resignation of Lord George Hamilton are recorded. During the year Brig.-Gen. A. M. Asquith, D.S.O., and Messrs. S. B. Joel, G. Leith, C.B.E., and E. R. Peacock were appointed to the board. The meeting is to be held on March 15th.

Mather & Platt, Ltd.

Mr. L. E. Mather (chairman) presided at the annual meeting on February 28th, and in presenting the report pointed out that the past year's profit was only slightly below the average for the two preceding years. Having regard to the troublesome times which had been experienced, they were thankful that such success had been attained. The directors had no hesitation in recommending the same dividend and bonus as for 1925. During the year the number of employés had been kept constant, and the output per man-hour had been maintained. The volume of orders was materially affected by the coal dispute and some were taken with a very small margin of profit, but they were not pessimistic. There were signs of revival in the cotton trade, and the collieries were beginning to make inquiries for electrical and pumping plant. Municipal contracts for extensions to electricity and pumping stations continued to be placed, but there was keen competition. Overseas trade had been disappointing, with one or two exceptions, but that was all the more reason for anticipating better times. Their French company had done well. Machinery was being supplied to Russia, and all payments had been made as they fell due. They were prepared to take further contracts on a similar basis, but the existing economic and political situation in Russia made it difficult to obtain further business on satisfactory terms.

Electrical Distribution of Yorkshire, Ltd.

The annual meeting was held in Leeds on March 1st. Mr. R. W. Wickham (chairman) presided, and in moving the adoption of the report and accounts (ELEC. REV., February 25th, p. 312) said that in spite of an increase of £12,000 in the cost of energy, through the coal dispute, they had made further reductions in their prices, had met new capital charges amounting to £17,000, had added £10,000 to the reserve fund, and had increased the balance carried forward by £1,500—a very gratifying result. The company was now the authorised distributor under 36 Electricity Orders covering an area of 960 square miles. When the company's outstanding applications had been dealt with, a supply of electricity for lighting purposes would be available in practically the whole of the industrial area of Yorkshire south of the River Wharfe. That marked the end of their original scheme, and they had broken new ground by making an application in respect of Ripon and district. There had been a steady growth in the use of electricity for street lighting, and the company now had agreements with a number of local authorities. The greatest development which had occurred during the year was in the direction of domestic supplies; the majority of the houses now being built were being wired for electric lighting, and provision was usually made for other apparatus. That development had been encouraged by the introduction of a two-part tariff. The board had under consideration a wiring scheme by which the installation would be paid for by a small addition to the price of energy. Supply to new housing estates through prepayment meters was growing. To meet those developments more capital was required, and in a few days the shareholders would be offered an issue of 300,000 new shares. Those shares would be offered in the proportion of three to every five held, and the price would be 25s. Mr. Wickham did not anticipate that the new Electricity Act would have any adverse effect upon the company.

Liverpool Overhead Railway Co.

The traffic receipts for the past year amounted to £83,997, and miscellaneous receipts to £5,289, making £89,286. Against this were charged working expenses £87,749, renewal fund £5,000, and contingent fund £400, leaving a deficit of £3,864. After meeting debenture interest this deficit is increased to £10,619, but against it are placed balance of compensation under the Railways Act, 1921, and the balance brought forward from 1925, reducing it to £3,069. The number of passengers carried fell from 7,896,572 to 7,006,230. There is stated to be little hope of material improvement in the company's prospects until trade revives. The report records the death of Col. H. Concanon and the resignation (on account of the pressure of official duties) of the Lord Mayor, Mr. H. C. Bowring. Their places on the board have been filled by Messrs. E. B. Orme and G. T. Phizackerley. The company's general manager and engineer, Mr. E. J. Neachell, has resigned owing to ill-health, and Mr. W. T. D. Grundy has been appointed to the position.

Stock Exchange Notices.

The undermentioned have been ordered to be officially quoted:—

Auckland Electric Power Board.—£250,000 5 per cent. water power conversion and general extension purposes debentures, Nos. 1 to 2,500 (£100) bearer.

Madras Electric Supply Corporation.—110,000 ordinary shares of £1 each, fully paid, Nos. 326,801 to 436,800.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Adelaide Electric Supply Co., Ltd.—250,000 new 6½ per cent. "C" cumulative preference shares of £1 each, partly paid and fully paid, Nos. 500,001 to 750,000 (ex dividend).

North Metropolitan Electric Power Supply Co.—850,000 ordinary shares of £1 each, fully paid, Nos. 1 to 850,000 (ex dividend).

Torquay Tramways Co., Ltd.

In the course of his speech at the recent annual meeting, the chairman (Mr. H. T. Barnett) said that up to July last matters looked very bad, but from that month onwards there was a marked recovery, and by the end of the year the traffic revenue was greater than that of 1925. The company had come to an arrangement with its omnibus competitors upon the Torbay road, which had resulted in improvement for both parties. The Babbacombe Cliff Light Railway was opened on April 1st, and the results had exceeded all expectations. Their subsidiary, the Devon General Omnibus and Touring Co., Ltd., had maintained its progress. It was not, however, intended that that company should declare a dividend on its ordinary capital until the reserve fund had been built up.

Isle of Thanet Electric Supply Co., Ltd.

The report for the year ended December 31st last shows a revenue of £151,167 and net income of £59,778. After meeting debenture interest and sinking fund and transferring £25,000 to reserve, and crediting interest (£519) and the balance brought forward (£3,504), there remains £23,800. The preference dividend is paid and one of 3 per cent. declared on the ordinary shares, leaving £3,460 to be carried forward. Although the coal dispute adversely affected the receipts, they were £13,176 in advance of the 1925 figure, while the expenses rose by £5,650. In March, 1926, an issue of 72,000 preference shares of £1 each was fully taken up by existing shareholders. The meeting was to be held on Wednesday last.

Mansfield and District Tramways, Ltd.

The profit for the past year was £5,039, and to this is added £1,148 brought forward, making £6,187. A balance of £2,608 remains after meeting loan and debenture interest, and £4,011 is taken from the contingency reserve, making £6,620. Of this £6,605 is put to debenture stock redemption funds, leaving £15 to be carried forward. In 1925 the preference dividend was paid and the ordinary shares received 5

per cent. The adverse result is, of course, due to the coal dispute, and the directors state that some time must elapse before conditions become normal.

Cambridge Electric Supply Co., Ltd.

The accounts for the past year show a profit of £35,361, to which is added £5,097 brought forward, making £40,458. After meeting debenture interest and taxation and transferring £10,000 to depreciation fund, £10,000 to reserve, and £1,500 to pension fund, there remains a balance of £11,905. It is proposed to pay a dividend of 7 per cent., leaving £4,905 to be carried forward. During the year a new Babcock & Wilcox boiler was installed, and the total capital expenditure was £22,283.

Llanelly and District Electric Supply Co., Ltd.

The profit for the last year, including £908 brought forward, was £31,546. After meeting debenture interest, &c., and allocating £2,500 to renewals reserve, the preference dividend is paid and £1,189 is carried forward. For 1925 a dividend of 5 per cent. was paid on the ordinary shares; last year the undertaking was very badly affected by the coal dispute, the net profit falling from £23,302 to £14,691. An improvement is recorded for the first two months of the current year.

The Mackay Companies.

The report for the year ended December 31st last shows a total income of $4,922,811 and an expenditure of $296,640, leaving a surplus of $4,626,171, which is added to the surplus brought forward, making $6,771,512. After paying dividends of 4 per cent. on the preferred and 7 per cent. on the common shares, a surplus of $2,160,401 remains. The investments stand at $92,883,716.

Clarke, Chapman & Co., Ltd.

The net profit for the past year was £13,453 (as compared with £33,194 in 1925) and after providing for maintenance charges, depreciation, &c., and adding £2,192 brought forward, there remains £8,135. The directors recommend the payment of the final dividend on the preference shares, but are unable to declare an ordinary dividend. For 1925 the dividend was 5 per cent. A balance of £3,246 is carried forward.

Galashiels and District Electric Supply Co., Ltd.

At the annual meeting on March 4th it was reported that there had been a steady expansion of business, and it would be necessary to extend the power station. The Special Order applied for should be ratified by Parliament within the next few days. It was proposed to increase the share capital from £100,000 to £200,000.

Westminster Electric Supply Corporation, Ltd.

The directors recommend a final dividend at the rate of £5 16s. per cent. upon the ordinary capital as increased by the recent bonus issue. The total dividend represents a return of 14.7 per cent., as compared with 15 per cent. last year.

British Insulated Cables, Ltd.

The directors recommend the payment of a final dividend of 10 per cent. on the ordinary shares, making 15 per cent. for the year. This is paid upon a capital increased in 1925 from £1,000,000 to £1,333,333. £285,000 is allocated to depreciation and reserve, and £271,000 is to be carried forward.

Charing Cross Electricity Supply Co., Ltd.

The directors recommend a final dividend on the ordinary shares of the West End Undertakings at the rate of 9 9/16d. per share. This, with the interim dividend already distributed, makes up the standard dividend for the year, in accordance with the London Electricity (No. 2) Act, 1925.

Vickers, Ltd.

The directors announce the payment of the final dividends upon the 5 per cent. preferred stock (less tax), the 5 per cent. preference shares (less tax), and 2½ per cent. upon the cumulative preference shares (free of tax).

Bournemouth and Poole Electricity Supply Co., Ltd.

The directors recommend the payment of a final dividend of 5½ per cent. upon the ordinary shares, making 10 per cent. for the year, together with a bonus of 4 per cent. free of tax. Last year's distribution was similar.

St. Maurice Power Co.

The total income for the past year was $1,031,379, as compared with $807,000 for 1925. After meeting expenses, rentals, and interest, $170,000 was transferred to reserve, and a balance of $627 was added to surplus, making $963.

Danish Company.

The *Nordisk Kabelfabrik*, Copenhagen, reports net profits of 1,578,000 kr. for 1926, and has declared a dividend at the rate of 5 per cent., as in each of the two previous years.

Globe Telegraph and Trust Co., Ltd.

A quarterly dividend of 2½ per cent. has been declared on the ordinary shares.

Reduction of Capital.

X-Rays Limited and Reduced.—A petition for confirming the reduction of the capital of the company from £75,000 to £24,265, has been presented to the High Court, and will be heard in London on March 22nd.

Richmond (Surrey) Electric Light and Power Co., Ltd.

A final dividend of 5 per cent., making 9 per cent. for the year, is recommended on the ordinary shares. Last year the old ordinary shares received 10 per cent.

Northern Mexico Power and Development Co.

A dividend of 1 per cent. has been declared on the common stock and a quarterly dividend of 1¾ per cent. upon the preference stock.

Brazilian Traction, Light and Power Co., Ltd.

A quarterly dividend of 1¼ per cent. has been declared on the cumulative preference shares.

Coatbridge and Airdrie Electric Supply Co., Ltd.

The directors recommend a dividend of 9 per cent. on the ordinary shares for the past year.

Western Telegraph Co., Ltd.

The directors have declared the second quarterly interim dividend of 5s. per share, free of tax.

Newcastle and District Electric Lighting Co., Ltd.

The directors recommend a dividend of 7 per cent. for the past year.

W. Canning & Co., Ltd.

A dividend of 10 per cent. and a bonus of 6d. per share are recommended on the ordinary shares for the past year.

Stocks and Shares.

Monday Evening.

Stock Exchange markets are in a fairly cheerful frame of mind. The Chinese trouble has faded into the background as a factor of disturbance to any markets except the few that are intimately connected with it. The people who, a month ago, were talking "dearer money" have changed their key, and investment stocks show general strength. A recovery in the rubber share market stands out conspicuously.

Reference was made here last week to the growing inclination on the part of holders of London electricity supply shares, to exchange the latter for shares in the big power undertakings. With nothing much to look forward to in the way of possible price appreciation, and with the knowledge of a common 7 per cent. dividend level to be reached after the end of 1931, the proprietor of the London companies' shares is asking whether he cannot obtain wider scope for dividend and profit in the power concerns. No doubt the proprietary of the average London company is composed mainly of investors pure and simple—people who, to use the Stock Exchange phrase, will never sell their shares until they are dead. Their investments are secure, were never more so, in the older electricity supply companies, and this is all they ask. But there are other shareholders who require a more extended prospect, and who turn to the power companies as offering what they, the investors, seek. Several of such shares are quoted in our weekly lists, but it may be of some service to set out in a separate table the principal provincial stocks and shares quoted in the Stock Exchange lists:—

Share.	Divd. %	Price.	Yield. £ s. d.
Clyde Valley ordinary	8	30/-	5 6 8
Do. first preference ...	6	22/-	5 9 1
Do. second preference	8	27/6	5 16 5
Co. Durham Electric Power Dis. debenture	5	87½	5 14 3
Elec. Dis. Yorkshire	8	31/3	5 2 5
Kent Electric Power debenture	4½	80½	5 11 10
Lancashire Elec. Light & Power ordinary	7½	24/6	6 2 5
Do. first preference ...	6	26/6	4 10 7
Do. second preference	7	26/6	5 5 8
Midland Counties Elec. ordinary	6	22/-	5 9 1
Newcastle-on-Tyne Elec. ord. ...	7	22/-	6 7 3
Scottish Power ordinary	8	25/-	6 8 0
Shropshire, Worcs. & Staffs. "A"	8	27/6	5 16 5
Do. "B"	6	23/6	5 2 2
Do. preference	6	22/-	5 9 1
South Wales Power preference	6½	17/6	7 8 7
Do. debenture	6	100½	5 19 5
Yorkshire Electric ordinary ...	8	29/6	5 8 6
Do. preference ...	6	23/-	5 4 4
Do. debenture ...	5½	101	5 9 0

The dividend on Lancashire Electric first preference is paid tax free and the company's 7 per cent. preference carry participating rights.

While the list of London electricity supply shares remains very firm as to its prices, the provincial group shows increasing strength. There are small rises in Clyde Valley, Midland Counties, Newcastle-on-Tyne and Lancashire Light and Power. Amongst the supply companies, Bournemouth and Poole has declared a final dividend of 5½ per cent., less tax, making 10 per cent., plus a bonus of 4 per cent., tax free, the same as last year. The price of the shares is unchanged at 60s. 9d. Isle of Thanet Electric Supply has raised its dividend by ½ per cent. to 3 per cent., and the figures in the report tell of satisfactory progress. The price of the ordinary shares is 16s.; the 6 per cent. preference are quoted at a guinea. The Richmond (Surrey) Electric Light and Power final dividend of 5 per cent. makes 9 per cent. for the year on the ordinary shares, standing at 30s. 9d.

The Westminster Electric final dividend for 1926 is declared on the capital as increased by the new shares issued at the end of last year through capitalisation of the company's reserves. The dividend is 5.8 per cent. on the whole capital, and makes 8.8 per cent. for the full year. This is equal to 14.7 per cent. on the capital before the latter was increased, and it goes against 15 per cent. paid for 1925. The yield on the shares at the current price of 25s. 6d. is £7 2s. 6d. per cent. now, but, as observed previously, our yield-table is calculated upon the 7 per cent. dividend that will obtain from the beginning of 1932. That this austere method is recognised as being strictly, if not mathematically correct, would seem reasonable to assume in view of the fact that no protest has reached us on the point.

Tube Railway stocks are slightly better on the week, Underground Electric Railways of London £1 shares firmed up to 16s. The company's report, published a few days ago, shows that the Associated Equipment Company enabled the payment of the maiden dividend of 1½ per cent. upon Underground £1 shares. The Associated Equipment contributed £60,000 to the Common Fund, and the dividend on the Underground shares took £76,000. The London & Suburban Traction is the Cinderella of the combine, the company paying nothing to the pool. At the meeting last week, the chairman said that what they needed was a little more fair play: the tramways stood at a disadvantage by having to carry workmen passengers at cheap fares, while its competitors were not subject to the same terms. The shares are a little better at 7s.

United River Plate Telephones are 2s. 6d. down after their big rise, said to be due to American buying for control purposes. International Automatic Telephone deferred, after their dip to 40s., have recovered to 43s. The ordinary have risen to 44s. 6d. Cable stocks present no features of interest. Globe ordinary shed 5s. to 18½. Westerns are unaffected by declaration of the usual quarterly dividend of 5s. per share net. Anglo-American deferred is ½ lower at 23½.

Foreign traction varieties are better. Anglo-Argentine Tramways preference, of both classes, have made further headway. Brrazilian Tractions went 3½ higher under buying pressure from Brussels, Montreal, and New York. The preferred are up to 116½. Mexican Utilities hold most of the substantial rises recently acquired. The Tramways firsts gained two points to 71½, and the seconds rose to 50½. In the Colonial stocks, British Columbia Electrics are heavy, the deferred going back to 154½, a 3½ points decline. City Services preferred have dropped 4 to 90½. An offer is being made, of 2½ million francs, in 7 per cent. bonds at 97½, by the Société des Forces Electriques de la Vallée de Gavarnie.

The recommendations of the Marconi Board are out at last. They have been so thoroughly canvassed in the Press that their detailed examination here might look out-of-date when these notes appear. Two main points are the proposal to reduce the nominal share value to 10s., by writing off 10s. per share, and the expression of opinion that such action will lead to an early return of Marconis to the dividend list. The English Shareholders' Committee adopted the unusual course of issuing a statement of its own on the eve of the company's announcement. At the moment, it looks as if two camps existed, and that between the two lies more than one gulf. Shareholders will probably be well advised to support the Marconi directors. To job backwards is useless. The future holds promise of success after the bitter lessons of the past. The price of the shares has gone back to 15s., but the writing-off of deadweight capital will make no difference to the market price of Marconi shares. Under reorganised conditions, the Marconi Company should rapidly regain much of the lost ground.

Johnson & Phillips are again the weak spot in the electrical equipment section. The shares are 2s. 6d. lower, following upon a similar drop in the previous week, and the only assumption advanced in explanation is that the dividend may prove disappointing. The announcement is due next month, and will compare with 2s. a year ago. In November, the interim dividend was 1s. per share. British Aluminiums are 9d. better at 47s. Edison 5 per cent. debenture is a point higher at 85. The company's 5½ per cent. second debenture stands at 81.

Babcocks are steady. Vickers have gained a trifle and Armstrongs went up a little upon rumours, denied though these were, that some kind of working agreement might be reached by the two undertakings. A feature in the Miscellaneous Market is a spurt in rubber shares. The produce hardened in price, and the share list responded with an all-round improvement in values, accompanied by a mild outburst of business activity.

Share List of Electrical Companies.

	Nom.	Dividend. 1924.	1925.	Price Mar. 7 1927.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	£1	14	14	60/9	—	4 12 0
Brompton Ordinary	£1	10	10	25/-	—	5 13 0
Charing Cross Ordinary	£1	15	15	26/6	—	5 9 10
do. do. 4½ Pref.	£1	4½	4½	17/-	—	5 6 0
Chelsea	£1	12	12	25/-	—	5 12 0
City of London	£1	15	15	2⅛	—	... ...
do. do. 6% Pref.	£1	6	6	23/-	—	5 4 4
Clyde Valley	£1	8	8	30/-	+6d	5 6 8
County of London	£1	15	15	27/6	—	5 1 10
do. do. 6% Pref.	£1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	£1	7	8	26/3	—	6 2 0
do. 7% Pref.	£1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	£1	10	10	30/6	—	6 11 9
Kensington Ordinary	£1	15	15	24/6	—	5 14 3
Lancs. Light and Power	£1	7½	7½	24/6	+6d	6 2 5
London Electric	£1	10	10	24/-	—	5 17 6
do. do. 6% Pref.	£1	6	6	5⅞	—	5 10 4
Metropolitan	£1	11	11	25/6	—	5 9 10
do. 4½% Pref.	£1	4½	4½	17/-	—	5 2 10
Midland Counties	£1	5½	6	22/-	+6d	5 9 1
Newcastle-on-Tyne Ordinary	£1	7	7	22/-	+9d	6 7 3
do. 5% Pref.	£1	5	5	17/6	—	5 14 3
do. 7% Pref.	£1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	£10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	£1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	£5	17½	17½	25 6	+6d	5 9 10
South London	£1	15	15	24/6	—	5 5 0
South Metropolitan Pref.	£1	7	7	1¼ xd	—	6 8 0
Urban Ordinary	£1	4	7	25/6	+6d	5 9 10
do. 6 % Pref.	£1	6	6	20/6	—	5 17 1
Westminster Ordinary	£1	15	15	25 6	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	£1	7½	7½	20/6	+3d	7 6 4
Yorkshire Elec.	£1	8	8	29/6xd	—	5 8 4
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	70 xd	—	5 14 4
Metropolitan	£5	5	5	63½ xd	—	4 14 6
do. District	£5	8½	8½	59½	—	5 18 8
Underground Electric	£1	Nil	Nil	16/-	+6d	1 17 6
do. do. Income	Bonds	6	6	10xd	—	*5 18 10
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	100	—	6 0 0
do. Def.	£1	1½	1½	23¾	—¼	6 6 0
Automatic Telephone	£1	8	10	53/3	—	3 15 0
Chili Telephone	£5	5	5	9½	—	4 12 4
Cuba Sub. Ord.	£10	5	5	7	—	7 5 8
Eastern Extension	£10	10	10	17⅞	—	*5 13 4
Eastern Tel. Ord.	Stock	10	10	172½	—	*5 16 0
Globe Tel. and T. Ord.	£10	10	10	18½	—½	*5 8 1
do. do. Pref.	£10	5	5	11	—	5 9 1
Great Northern Tel.	£10	22	20	26⅔	—	7 10 0
Indo-European	£5	9⅓	10	46½	—	*5 7 6
Marconi	£1	10	Nil	15/-	—¼	... ...
Marconi-Marine	£1	10	7½	1¼	—	6 13 4
Oriental Telephone Ord.	£1	12	12	2⅜	—	*5 1 1
United R. Plate Tel.	£5	8	8	8¾	—½	*4 11 5
Western Telegraph	£10	10	10	17	—	*5 17 8
HOME AND FOREIGN TRAMS, &c.						
Anglo-Arg. Trams First Pref.	£5	5½	5½	3⅞	+⅛	8 12 6
do. do. 2nd Pref.	£5	6	6	3⅞	+⅛	9 8 3
do. do. 5% Deb.	Stock	5	5	71½	—	7 0 0
British Electric Traction Ord.	£1	7	8	145½	—	5 10 0
do. do. 6% Pref.	£1	6	6	109	—	5 10 1
Brazil Traction	£10	4	5	128	+3½	4 13 6
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	£1	90/-	126/9	116½	—4	*5 7 6
do. do. Deferred	£1	129/8	8	154	—3½	*5 4 0
do. do. Deb.	£1	4½	4½	81½	—	5 4 4
London & Sub. Trac. 5% Pref.	£1	2½	Nil	7/-	+6d	Nil
London United Tram. Deb.	Stock	4	4	49½	—	8 1 8
Mexico Trams, 5% Bonds	—	5	5	71½	+2	6 19 10
Mexican Light Common	£100	Nil	Nil	43	+1	Nil
do. Pref.	£100	Nil	Nil	96½	+1	Nil
do. 1st Bonds	—	5	5	70½	—	7 1 10
Yorkshire (West Riding)	£1	8	—	8/9	—1/3	... ...
MANUFACTURING COMPANIES.						
Babcock & Wilcox	£1	12	18	62/6	—	4 19 1
British Aluminium Ord.	£1	5	10	47/-	+9d	4 5 1
British Elec. Transformer Pref.	£1	Nil	7	18/3	—	7 13 8
British Insulated Ord.	£1	15	15	68/9	—	4 7 3
Brush Ord.	£1	10	10	28 3	—	7 1 7
Callenders	£1	15	15	8½	—	4 5 9
do. 6½% Pref.	£1	6½	6½	23/9	—	5 9 8
Crompton Ord.	£1	Nil	Nil	10/-	—	... ...
Edison-Swan	£1	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	85	+1	5 17 8
Electric Construction	£1	10	10	81/3	—	6 8 0
Enfield Cable Pref.	£1	7½	7½	1¼	—	6 6 4
English Electric	£1	5	Nil	13 9	—9d	... ...
do. do. Pref.	£1	5	5	17/6	—	6 17 1
Gen. Elec. Pref.	£1	6½	6½	23/6	—	5 12 9
do. Ord.	£1	5	7½	31/-	—	4 16 9
Henley	£1	18	20	89/3	—	4 9 8
do. 4½% Pref.	£5	4½	4½	4½ xd	—	5 6 0
India-Rubber	£1	5	5	1	—	*5 0 0
Johnson & Phillips	£1	10	17½	2½	—½	6 10 1
Met.-Vickers Ord.	£1	8	8	23/3	—	5 13 3
do. Pref.	£1	8	8	3⅛	—	6 18 4
Siemens Ord.	£1	7½	7½	29/6	—	5 1 8
Telegraph Construction	£2	20	10	29½	—	*4 0 8

* Dividends paid free of Income Tax

The British Industries Fair.—IV.

Proceedings and Exhibits at Birmingham.

THE Fair closed on Friday last amid expressions of satisfaction from the bulk of the exhibitors. The actual business done was substantially in advance of that of previous years, and inquiries which should bring forth fruit in due season were numerous. Our Birmingham correspondent states that, as a result of this year's experience, it is probable that the accommodation at Castle Bromwich will be further increased by next year. It is thought that another building will be erected between the existing buildings "A" and "B," which are at present connected by a long corridor in which serious congestion has taken place.

While it is very difficult to gauge with a high degree of accuracy the extent of the business done, it may be worth while to record the official estimate. This places the value of orders actually obtained at £4,000,000, while the business which is likely to accrue during the next twelve months as the result of the Fair is put at between eighteen and twenty millions. According to the same official source, the branches in which the bulk of the business was done included switchgear, internal-combustion engines, colliery plant, lamp shades, and boiler and engine room plant.

Our own impressions, gathered from exhaustive inquiries at the electrical stands, confirm the optimism thus officially expressed. While, of course, actual figures were not disclosed, practically every company interviewed was pleased with results, and satisfied that its efforts had not been wasted.

One of the leading electrical companies stated that the volume of orders for all departments was satisfactory, the majority being for the home market. There were several important foreign orders and inquiries. Excellent results were reported by a well-known company which makes electric fires; 50 fires were sold in one day, there being many oversea buyers. One switchgear company reported orders from India, and another received promising inquiries from Canada. Another company manufacturing electric fires and other appliances, which is a regular exhibitor at the Fair, considered that this was the best year so far as it was concerned. An electric vehicle firm noted as an interesting point that many small firms made inquiries regarding its products. One of the smaller companies dealing with domestic appliances said that it had done far better than it had hoped to do. A number of good orders and sound inquiries regarding water-heating apparatus were received by another London company of electrical manufacturers. Some makers of electric heating and cooking apparatus said that, although the volume of orders was not very large, a number of inquiries had been received which appeared certain to bring in business from entirely new directions. The foregoing are typical replies to questions put to the exhibitors. Only one firm seemed dissatisfied with results so far as orders were concerned, but even in this case it was admitted that many useful "contacts" had been made.

We are convinced that the Electrical Section of the Fair, at least, has been a success, and we call for the co-operation of British electrical manufacturers in ensuring a continuance of that success.

The Department of Overseas Trade announced last week that the Government intended to repeat its grant of £25,000 for publicity purposes in connection with next year's Fair.

About 90 per cent. of this year's exhibitors have notified their desire to show again next year, and in many cases increased space is required.

THE BIRMINGHAM SECTION.

An Electrical Luncheon.

ON March 3rd there was a further concourse of electrical visitors at the Fair. They included delegations from the Incorporated Municipal Electrical Association, the British Electrical Development Association, the Provincial Electric Supply Committee of the United Kingdom, and the Electrical Association for Women. The delegates took lunch at the invitation of the Fair Council.

Mr. T. R. MARTIN (chairman of the Fair Management Committee), who presided, pointed out that the Fair had doubled its size inside two years.

Mr. W. C. P. TAPPER (borough electrical engineer, Stepney) observed, in reply to the toast of "The Visitors," that the electrical industry had suffered less than many trades during the period of depression. It was busily engaged in re-organising itself in view of the operations of the new Electricity Board. That re-organisation should result in rapid progress, and the electrical industry was hoping to carry the other industries of the country along with it.

Lady BROOKS, President of the Midlands Branch of the Electrical Association for Women, said it was the hope of women that they could indirectly help the electrical industry enormously.

The toast "The Electrical Industry," was proposed by Ald. W. WALKER, of Manchester (a member of the new Central Electricity Board), who said he only hoped that the forecast of politicians, that within a short period everybody in the country, in towns, or remote villages, would have at his disposal electricity without any trouble, would be realised.

Mr. R. A. CHATTOCK, city electrical engineer, Birmingham, replying, suggested that the various associations in the electrical industry should get together and see to it that at next year's Fair, all electrical wares and developments were shown in one building. The effect of that would be to stimulate buying for the home and the export markets. The electrical industry had been marking time, but was now desirous of going ahead.

Mr. J. W. BEAUCHAMP, director of the British Electrical Development Association, pointed out that whether we got electricity at a very cheap rate or not, would depend more than anything else on the amount the public consumed.

W. McGeoch & Co., Ltd.

Upon this stand there appeared a very varied selection of lighting fittings and switchgear. Among the former were ships' fittings of all kinds, including navigation lamps and indicators; there were also standards, pendants, &c., for the home. Self-aligning porcelain-handled fuses were shown as well as battery-charging boards, distribution boards, knife switches, lampholders, plugs and sockets, and ironclad switchgear, including colliery types.

R. A. Lister & Co., Ltd.

Two small lighting sets were shown by this company rated at 1 kW and 1½ kW respectively. In both cases the prime movers were the company's standard petrol engines, and the switchboards formed an integral part of the set. The engine is of the 4-stroke pattern equipped with automatic lubrication, and is claimed to have a very low fuel consumption—2.25 pints of petrol per b.h.p.-hour on full load. The dynamo is a 4-pole protected-type machine. It is shunt wound for battery charging and is also provided with powerful series starting windings to enable the plant to be started by means of the battery. The rating is a conservative one.

Thos. J. Digby Illuminating Engineering Co., Ltd.

The principal exhibit of this company was the artificial daylight apparatus. The "Trulyte" system is made up into special units for colour matching, photography or ordinary lighting purposes. Another device shown was a combination spot light employing a 400-W tubular projector lamp. The device is fitted with a set of lenses for giving spots of varying size and intensity.

Cambridge Instrument Co., Ltd.

In addition to the large and representative selection which was shown on its own stand, various "Cambridge" temperature-measuring and engineering instruments were in operation on other stands in various parts of the exhibition. For example, in connection with the John Thompson water-tube boiler, there was a panel of "Cambridge" instruments, comprising an index thermometer for measuring the temperature of the exit gases, a draught gauge and an illuminated CO_2 indicator, all with 13-in. dials. The last instrument was exhibited publicly in actual operation for the first time. It was connected up to a working Cochran boiler mounted on the stand of Messrs. Cochran & Co. (Annan), Ltd. The indicator possesses many novel features which greatly facilitate the work of the stoker. The actual figure representing the CO_2 percentage is illuminated by a white light, while the pointer, in line with it, is illuminated by a green light if the percentage is increasing, and by a red light if it is decreasing. A "Cambridge" thread recorder, working in conjunction with the above CO_2 apparatus, was shown on the company's own stand. This stand bore a large and varied selection of instruments. The dissolved oxygen recorder shown recorded the percentage of oxygen on a chart calibrated in cu. cm. per litre of water. The full scale deflection on the chart corresponds to one cubic centimetre of oxygen per litre. The apparatus may be arranged to operate an alarm. The CO_2 and CO indicator which was shown is electrical in principle, and contains no chemical absorbents or fragile glass work. The apparatus is robust and needs little attention. It comprises a CO meter panel connected to an indicator, together with a CO_2 meter, soot filter, and bubbler-aspirator. The Cambridge dial gauges, also exhibited, are convenient, robust, and moderately-priced indicators for the measurement of draught or pressure up to 60 in. of water. They can be arranged to indicate directly the difference in pressure between two points. The exhibit also included draught and pressure recorders (for ranges up to 60 in. of water) and pressure and vacuum recorders with circular charts 9½ in. in diameter (for ranges up to 1,000 lb. per sq. in.). One of the pressure recorders was in operation, showing the pressure of the steam in the exhibition power plant. The temperature-measuring instruments included various patterns of the firm's "Easy-to-Read" dial thermometers, which are suitable for steam plant, refrigerating plant, &c., in marine and land installations. These thermometers are of the vapour-pressure type, and an important feature of the design is that changes in the temperature of the indicator or of the flexible tubing do not affect the accuracy of the readings. This enables the instrument to be installed at some distance from the place where the temperature is being measured. Electrical distance thermometers formed an important part of the exhibit. Indicating, recording, and combined indicating and recording outfits are made. A portable resistance pyrometer outfit; thermo-electric pyrometers; stator and rotor temperature measuring outfits; radiation and optical pyrometers; a disappearing filament pyrometer; and many other instruments were displayed.

H. H. Vivian & Co., Ltd.

This company exhibited bus-bars, condenser tubes, and high-conductivity copper strip, tape, and sections for electrical purposes.

E. Brook, Ltd.

Chief among the exhibits of this firm was a 30-h.p. motor in half section, showing all internal parts, including slip-rings, and a 5-h.p. motor on a revolving base. The latter machine had both end plates removed in order to expose the internal parts, especially the windings. Other exhibits included the rotor of a 75-h.p. motor on ball-bearings, a showroom motor, a loom motor, a buffing motor on stand, squirrel cage motors, slip ring motors, three starters with automatic features, parts of slip rings, brush gear, rotor bars, ball and roller bearings, slide rails, pulleys, &c.

C. H. Parsons, Ltd.

Once again this company presented a very comprehensive display of its switches, electric lamp holders and accessories, in addition to one or two new lines. These included a 2-pin, 10-A switch plug, a 3-pin, 10-A switch plug with earthing device, a shock-proof switch plug, and a range of flush-type switches in iron boxes. All of these were of excellent construction and finish.

Allen-Liversidge, Ltd.

In addition to a great deal of oxy-acetylene equipment, this company showed examples of "Pontelec" welding apparatus (made by Messrs. Buckley, Saunders & Co., Ltd.). These included spot, seam, and butt types of various sizes. One machine was a 3-kW butt welder, designed for the cable industry, and it is capable of dealing with wires up to large gauges in copper, brass, or steel. Samples were shown of work carried out by a spot welder for the treatment of aeroplane wings, and other samples displayed the results of the use of a flash welder which can deal with angles and sections of steel, such as casements. The spot welders have water-cooled electrodes and an automatic trip control switch by which the current is only allowed to remain on during the short period required for the weld. Numerous photographs of welders and welded products appeared on the stand.

Heenan & Froude, Ltd.

Various types of apparatus for power station work were exhibited by this firm, noticeable amongst which was the "Heenan" patent stationary cooler, which can be put to numerous uses, such as an air purifier or cooler, water or oil cooler, humidifier, or dehumidifier. Other exhibits included a stationary air filter, enclosed-circuit air coolers, and the Heenan "K" type water cooler.

J. A. H. Hunt.

On this stand was exhibited a complete range of new models of decorative house lighting fixtures. These have been designed and manufactured especially for the present demand for better-class materials at reasonable prices. There were also shown some examples of wrought iron units for the exterior lighting of public buildings, &c., and several illuminated signs.

Pritchett & Gold & E.P.S. Co., Ltd.

This company exhibited a few of its different types of accumulators for country house and central station work, and also various types of train-lighting accumulators. These demonstrated the patent anti-splash lids, special grids, and other features. A complete stationary battery was erected on the stand for the purpose of showing the construction. Component parts and a number of small accumulators for special purposes, such as wireless, were also exhibited.

Carron Company.

A large selection of its electric fires and irons was displayed by this company, but the principal electrical appliance shown was a baking oven. This is a two-compartment oven, each compartment having a 6-kW loading, and a baking space measuring 3 ft. 2 in. by 2 ft. 10 in. by 11¼ in. The appliance is constructed of cast-iron and sheet steel, double-cased and lagged. The baking sole-plate of each deck is formed of cast-iron frames with firebrick tiles bedded down with fireclay. The bottom elements are fixed under the soles but not in contact with them. The top and bottom elements are controlled by three-heat "Diamond H" snap switches. Provision is made for a steam jet. Two domestic cookers were also on view. The smaller has a total loading of 6,750 W, which includes a 1,600-W and a 1,750-W boiling plates, and a 1,600-W grill. The boiling plates can be of the open-coil or the solid types. The oven space measures 14 in. by 13½ in. by 12½ in. The construction is of cast-iron and mild steel, double-cased and lagged. The other cooker was similar in construction but larger, having a total loading of 8,200 W and three boiling rings. In this case the oven space is 16 in. in each direction. All the elements of both cookers are fitted with three-heat controls.

J. H. Tucker & Co., Ltd.

This company again showed a most comprehensive range of its varied manufactures. Among these was a new double-pole ironclad switch incorporating a quick-make, quick-break positive action. It is designed on sound mechanical lines, and the switch is rated at 15 A, 250 V, or 10 A, 500 V, and independent tests have demonstrated that it is capable of breaking 50 per cent. overload at 50 per cent. excess pressure. A combined switch and fuse is also available with similar switch action (fig. 14). An interesting feature is the provision for adaptors, which provide facilities for the use of screwed conduit. There was a new ironclad cut-out which is rated at 15 A, 250 V, or 10 A, 500 V, the efficiency of which is claimed to be of very high order, adequately complying with the short-circuit tests laid down by the I.E.E. The fuse handles are of the non-reversible, self-aligning type, fitted with a permanently fixed asbestos tube. The contacts are substantially made in phosphor bronze. A novelty in switchplates was shown. These were of moulded "Telacite," a material which is especially

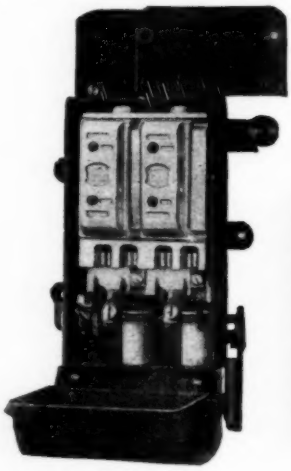


Fig. 14.—A New Tucker Switch-Fuse.

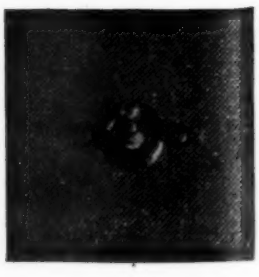


Fig. 15.—A "Telacite" Switch Plate.

suitable for the purpose. A novel method of fixing the plate to the switch dispenses with the need for switch rings. The surface of the plates is finely cross-cut, giving an attractive matt finish (fig. 15). As an "all insulated" plate, it has distinct advantages over glass, or other fragile material. The finish of the plate is dark brown. Adjustable grid boxes were shown in a variety of ways, and fitted with various accessories. Steel corner adjustment pins are now provided instead of brass, and the plates are secured by rings or corner fixing screws. Large quantities of these boxes have been recently used on important wiring contracts. Another new line was a quick-make, quick-break pear switch, the action of which is similar to the well-known "Tucker" push-bar lampholder. Since the last Fair was held, Messrs. J. H. Tucker & Co. have largely developed the heavy duty quick-make, quick-break switch, which was an outstanding feature of their exhibits a year ago. It is now available not only in 5-A and 15-A ordinary flat types, but also in semi-recessed, earthing types, locked covers, switch sockets, flush switches and practically in all types and patterns. A 5-A switch of this new type has successfully broken a load of 33 A at 250 V. Fuseboards and distribution boards in iron and teak cases in a wide variety of types, Home Office, channel, solid block, &c., and knife switches, power fuses, and gear for switchboard mounting up to 1,000 A formed an interesting display of the heavier products. Ironclad switches and combined switch-fuses, double- and triple-pole, up to 100 A were shown in several types, and there were also on view house service fuse boxes, ceiling roses, plugs and sockets, lampholders, switchplates, &c.

Rainsford & Lynes, Ltd.

The principal exhibits on this stand were Phillips's patent "Supersize" fittings for electric lighting, which are this company's latest product. These are constructed along rather original lines. A simple and ingenious arrangement of the stem of both the pendant and the wall brackets allows them

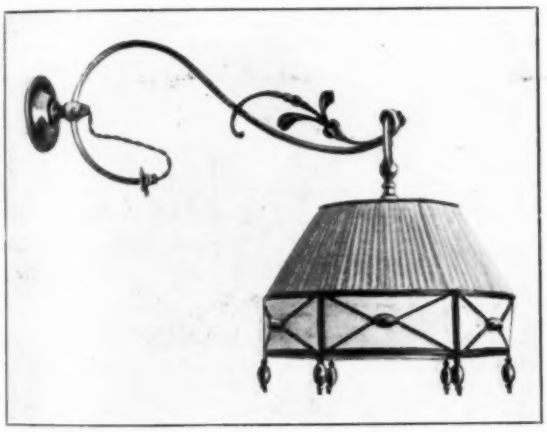


Fig. 16.—A "Supersize" Lighting Bracket.

a rise and fall movement, and also gives the wall brackets a lateral movement of 180 deg. This arrangement can be seen in fig. 16. The rise and fall movement puts no strain on the flex and requires no balance weight, so that shades of any weight or design can be used. The design of both the pendant and the wall bracket are very good.

Hart Accumulator Co., Ltd.

On the stand of this company was displayed a representative collection of products of interest to all classes of users of electrical storage batteries. For low-tension wireless circuits there were the types known as "Magno," "Enduro," and "RME." These cells are assembled in specially moulded pressed glass boxes, upon the insides of which are moulded ribs or grooves which extend almost to the bottom of the box, between which the plates themselves rest. This design obviates the need for bottom blocks, and the absence of these provides a larger space for the collection of deposit from the plates, as also for a greater volume of electrolyte. As an additional safeguard, these particular cells are equipped with corrugated sheet ebonite separators. The "RME" type is intended primarily for use with valves requiring considerable current. The general finish resembles that of the "Magno" and "Enduro" types, whilst the accumulator is also provided with connectors, manufactured from an alloy of non-corrodible metal, suitable for connecting several cells together when a battery is required consisting of a number of these cells. The "MEZ" type of ebonite accumulator is specially suitable for tropical climates in which the atmospheric conditions may make the use of celluloid batteries inadvisable. "Hart" high-tension accumulators were also exhibited. The container consists of a moulded glass box which is provided with grooved bottom rests into which the plates fit. The lid is of ebonite, sealed to the cell with a special compound, and when assembled into batteries the cells are connected to each other by connectors made from a non-corrodible alloy, which also serve as points of contact with a wander lead fitted with clip terminals. Both the positive and negative plates are covered with sheets of perforated ebonite, which completely envelop the plates, thus preventing any dislodging of the active material from the grid structures. Other exhibits included batteries for private house lighting, central station work, yacht lighting, &c.

Hewittic Electric Co., Ltd.

The d.c. supply for the Fair was converted from the Birmingham 5,000-V, 25-cycle supply by a mercury-arc rectifier equipment made by this company, upon the Corporation's stand. This had a capacity of 460 kW, and comprised a 280-kW equipment feeding into the outers, and a 180-kW equipment feeding into the inners of the three-wire d.c. system. This arrangement illustrated two types of equipment, as supplied for boosting (feeding across the outers) or for feeding into a three-wire system, and dealing with the out-of-balance load (inners). One of the developments which have taken place in connection with rectifiers has been in the means of voltage regulation. This used to be obtained by means of tapped auto-transformers controlled by tapping switches, the latter being operated either by a handwheel from the front of the cubicle, or by a motor, controlled by a pressure relay. This means is still employed, and gives every satisfaction, but on the larger units the company has adopted the use of an induction regulator controlling the primary supply into the step-down transformer which feeds the rectifier sets, as this method becomes then more

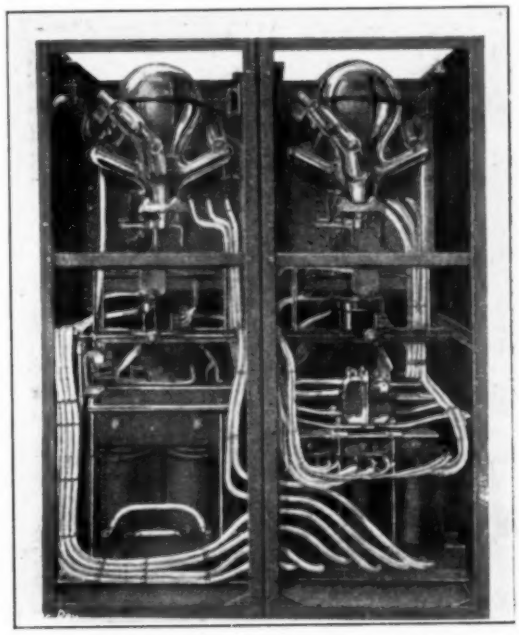


Fig. 17.—Hewittic Mercury-vapour Rectifier Cubicles.

economical, besides offering a finer means of regulation. While the rectifier first entered the field in connection with small sub-stations, it is now being used extensively for capacities up to 1,500 kW, and the company has a 2,000-kW substation which has been running for more than 12 months. The chief characteristic of the rectifier as a convertor lies in the fact that the plant is static, and it is simple and almost inherently automatic. It requires a minimum of attendance, and if it is desired to make it absolutely automatic either by means of pressure and current control, time switch, or remote control, the gear necessary entails a very small number of relays. Fig. 17 is a rear view of two typical light and power cubicles. On the company's stand various other products were exhibited. Among these were "Service Light" lamps for industrial lighting. These are divided into two kinds. Lamps with long tubes are used for normal workshop lighting, while silica lamps are employed for yard lighting and lofty buildings. "Service Light" is quite characteristic, giving a thoroughly diffused glareless light which, it is claimed, offers the nearest approach to daylight obtainable from a commercial illuminant. This results from the fact that the light is emitted not from a point source, but from a surface of considerable area. The lamps are also very efficient from the current consumption point of view; for long-tube lamps it is ½ W per c.p., and for silica lamps it is ¼ W per c.p. All the lamps start automatically on the closing of the switch controlling their circuit. Owing to the high actinic value of mercury-vapour light, it is used by all the leading photographers for studio work, printing, enlarging, &c. Typical photographic outfits were displayed. The mercury-vapour light is also very rich in ultra-violet rays. The company exhibited the Hewitt-Levick "Ulviarc" lamp for radio-therapeutics, water sterilisation, testing of dyes,

treating of leather, and other purposes, as well as other medical lamps for similar purposes. Other exhibits were cabinets for testing purposes, a small water steriliser, and small rectifiers for battery-charging purposes.

John Harper & Co., Ltd.

Castings for electrical machinery were shown on this stand, a special display being made of castings for switchgear and instruments.

Imperial Engineering Co., Ltd.

This company had a comprehensive exhibit of its electrical appliances for domestic use. Noticeable amongst them was the "Imperial Senior" electric iron, which embodies a number of improvements. It is heavily nickel-plated, and the element is of high quality hard mica, wound with nichrome ribbon. The thumb rest is of green erinoid. Another appliance shown was the "Carlton" electric heater. This is an artistically-designed heater of the portable type, there being three elements with a four-sided sloping reflector. It is made of solid copper, highly polished, and mounted on a cast-iron pedestal. Four types of electric fire were also shown. Conspicuous amongst these was the "Midland" design, which is a handsome cast-iron front fire with a polished nickel-plated bowl, 12 in. in diameter, the element being of the spiral type. It is made in three loadings, and can be supplied with either oxydised copper or oxydised silver finish. Other exhibits on this stand included "Imperial" immersion heaters, and the "Imperial" toaster, which is made for all voltages.

Runbaken Magneto Co.

On this stand was exhibited, amongst other things, apparatus specially designed for automobile electrical repairs. One exhibit was a starter battery test meter. This is constructed on the principle that to form an opinion as to the state of a cell without first dismantling it, it is necessary to subject it to a heavy rate of discharge and a simultaneous voltage test, the voltage under these conditions varying in relation to the current discharging; an undue voltage drop during discharge can be taken as a positive indication of serious trouble. Thus it is possible to isolate a particular cell as defective. With this instrument a load up to 250 A can be applied at the time of testing, and a small inspection lamp is provided which, in addition to lighting up the face of the meter, gives an indication of the state of the cell. The meter, which indicates both volts and amperes, is of the moving coil type, and robust in construction. The prongs are of hardened nickel steel and are readily renewable. Another interesting exhibit was the "Runbaken" spotlight and portable lamp, which was recently described in this journal.

Rawlplug Co., Ltd.

The principal exhibit of this company was a comprehensive range of "Rawlplugs," which are too well known to require describing here. Every size, ranging from ¼ in. to 4 in., was shown, together with the accompanying "Rawldrill." A more recent line exhibited was the "Rawlplug" bolt anchor, an invention which enables exceedingly strong fixings to be obtained for bolts in practically any kind of hard material. It is constructed from specially chilled iron in combination with lead, and is so formed that when fixed in position upon the head of a bolt, the chilled iron section forms a series of struts between the bolt-head and the walls of the hole, the result being that it is impossible to withdraw the bolt until the walls of the hole itself actually break away or the bolt fractures. In actual tests a ½-in. diameter bolt used in conjunction with a bolt anchor sunk in concrete has withstood a pull of about 3½ tons. It is unaffected by atmospheric conditions, and can be safely fixed under water when necessary. Another new line shown was "Durofix." This is a new kind of adhesive possessing the property of resistance to both heat and water; it is ready for instant use without first warming. It is strongly adhesive, and, since it is colourless, invisible joins can be made with it.

Jackson Electric Stove Co., Ltd.

This company had a display of eight electric cookers, ranging from the "No. 18" model with a maximum loading of 2.8 kW, to the "No. 24" model with a maximum loading of 8 kW, and capable of catering for 10 to 14 persons. All these models are designed on the same principles, the only difference being in the size, and the addition of certain accessories. The chief point of interest is the boiling plate, to which the makers attach considerable importance. This is of the "fully-protected" type, for which a patent has just been granted. A channel-shaped reflector of aluminium alloy carries the fireclay supporting pieces, and these, together with specially shaped fireclay end blocks, are held together by removable rods, which serve also to support the element in position under the cooker hob plate. The heating spirals are laid in slots in the fireclay blocks, and, to prevent sagging between these supports, fireclay rods are threaded through the spirals. Over the top of the element is fitted an inverted shallow metal tray, which provides full protection against spilt liquids and foodstuffs coming into contact with the spirals. These protecting covers are attached to the cooker hob, and access to the element can only be obtained from the underside by raising the hinged hob plate. All the metal parts of the element, with the exception of the terminal nuts and bolts, are of rust-proof, non-corroding alloys. Other interesting exhibits on this stand included electric wash boilers (which are supplied with the "Perco-Wash" spraying device), bath water heaters, hot water tanks arranged with a continuous low loading and with or without boost or thermostatic control, breakfast cookers, fires, kettles, &c.

Berry's Electric, Ltd.

This year the company had two separate stands. One of these was covered in to provide semi-darkness, in which a number of "Magicoal" fires could be seen to the best advantage. The other stand was mainly devoted to switchgear. A prominent feature was a "Viking" ironclad switchboard; this type of board has open access to the bus-bars and can easily be extended. There were also examples of interlocked foolproof circuit breakers and fuses, including a 3-pole, 200-A pattern. Switches of the "Firimine" and "Firadanac" type were shown; as their names imply, these are designed for colliery use. A section of the stand was given up to "McLary" cookers," the manufacture of which the company is undertaking. In this type of cooker the oven elements are plugged in, while the hot plates are removable bodily, being also of plug-in design. Other points are a separate socket for an iron, a door thermometer and three-heat snap switches for all the elements. The exhibit also included instruments by Messrs. Nalder Bros. & Thompson, Ltd.

Hendon Electric Lamp Co., Ltd.

Examples of "Hendon" lamps, lampholders, and switches were shown, among the apparatus being the "Unique" shade carrier. This is designed to replace the ordinary shade ring which with many types of fittings is very difficult to manipulate. The carrier consists of two rings, between which is a strong helical spring. The upper ring actually retains

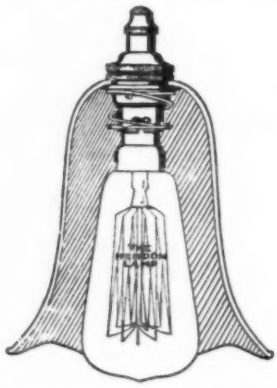


Fig. 18.—The "Unique" Shade Carrier.

the shade in position; a lug on the lower one engages in the lamp slot. For this purpose the slot has to be cut extended the opposite direction. This, of course, necessitates a special form of lampholder which the company provides. It also supplies a special tool by means of which the ordinary pattern of lampholder can be cut in the necessary manner. The carrier is slipped over the lower part of the lampholder, and when the lug on the bottom ring engages in the slot the top ring presses against the shade and is kept in position by the spring. The device is illustrated in fig. 18.

Holden & Hunt.

One of the principal attractions at this stand was the automatic wire-bending machine, which, with the chain welder, was seen making chain direct from wire. This was the No. 2 size, which is capable of forming ordinary and block chain from wire up to 5/16 in. diameter at the rate of 50 links a minute. The bender, which is of massive construction and well proportioned, was driven by a 2-h.p. motor. Another exhibit was the double-headed rivet heater, which has several unique features. The machine is rated at 25 kW and is capable of heating 200 ¾-in. diameter rivets per hour, the time for other sizes being in proportion. In addition to the No. 3 size universal spot welder, there was shown a larger size of spot welder. This was the No. 4 size, which has a rating of 25 kW, and is capable of welding iron and mild steel up to ¾ in. added thickness on repetition work, or ½ in. added thickness occasionally. The No. 3 size is a 12-kW machine and will weld up to ¼ in. added thickness on repetition welding, or 5/16 in. occasionally in iron and steel. These spot welders are free from any risk of electric shock, and even during the progress of welding all exposed parts can be handled freely. An automatic trip switch of simple design and having a wide range of adjustment is fitted, the renewable contacts being made from non-arcing metal. The heating speed is controlled by means of a four-way regulator, whilst the water-cooled electrodes can be fitted quickly and easily with renewable tips of varying

shapes to meet different requirements. A well-designed example of hand-operated butt welding machine was also displayed. This is intended primarily for heavy jobbing work and is capable of welding up to 1 square inch section. It is rated at 30 kW, and is designed on principles of strength, easy adaptability for undertaking a wide variety of work, and extreme accuracy of alignment under the heavy "upsetting" pressure required. The machine is water-cooled throughout, and the "upsetting" pressure is applied by means of a powerful eccentric cam designed to give the pressure in a direct line with the required "upset" and to prevent any twisting or unbalancing force from acting on the slide. The switch is foot operated, and the heating speed is controlled by means of a three-way regulator. The application of butt welding to light engineering work such as joining lengths of wire together, welding nickel pins to steel shanks for sparking plugs, &c., was illustrated by the No. 2 size wire welder. This machine, which is rated at 4 kW, is very sensitive and efficient, being capable of welding iron and steel (mild or high carbon) up to 5/16 in. diameter, brass and similar alloys up to 3/16 in. diameter, and copper up to ¼ in. diameter. A heavy cast-iron body completely enclosing the high-pressure parts is carried on a rigid cast-iron stand, the whole being mounted on wheels. A ½-kW bench wire welder was also shown.

Dundee Electrical Repairs Co., Ltd.

This company exhibited a control pillar for d.c. motors, comprising a d.p. isolating switch, two s.p. overload trips, with time-lag device, two s.p. contactors, starting switch and shunt field regulating switch, all mounted on an enamelled slate panel enclosed in a sheet-iron case. The starting switch eliminates pitting and burning of the short circuiting brushes and resistance contacts. This is accomplished by the introduction of a second moving brush capable of carrying the main current. By a simple method, this second moving brush is prevented from carrying any current at those periods when it bridges any two resistance contacts; hence there is no overloading of the brushes and contacts. The starting switch and shunt regulating switch are moved horizontally through a screw and nut, the handles projecting through the right-hand side of case and also that of the isolating switch. Two push buttons are provided on the front of the panel, one for "inching" and the other for stopping. The shunt regulating switch is electrically interlocked, so that the motor will not start up on a weak field.

International Combustion, Ltd., and the Underfeed Stoker Co., Ltd.

Upon this joint stand were several examples of pulverised fuel and other boiling firing equipment. Among these were a model "Raymond mill," complete with cyclone separator, for use in power plants for pulverising coal and for the grinding of many other materials; a "Lopulco" feeder of new design and a section of a "Lopulco" combustion chamber, showing arrangement of the Murray walls; Murray fin-tubes, the fin of one tube being staggered in relation to that of the next tube, and taken up to (wooden) headers; an "Usco" unit pulveriser, in which the fuel is treated by causing the particles of coal to come into contact with each other at a fairly high speed; an "Usco" air heater, consisting of a series of hollow elements inside of which flows the air to be heated, whilst around them flow the flue gases, in a contrary direction; impelled draught furnace fronts, a sort of "half-way house" between hand firing and mechanical stokers; and a "H" stoker with several new features.

Callender's Cable & Construction Co., Ltd.

This stand was arranged to show the company's capabilities in the way of providing apparatus for dealing with power in large quantities as well as in smaller (domestic) quantities. A special feature was made of the "Kaleeco" wiring system, and samples were shown of the special fittings and wire used. Among the principal points of the latter are a special earthing wire laid beneath the metal sheathing, and the entire absence of hygroscopic tapes. Many samples of cable were shown, and a large part of the stand was occupied by typical transformer kiosks, which are made for pressures of from 3 to 11 kV. The l.p. panels were fitted with enclosed fusegear. The bodies are either of cast iron or all steel. Other exhibits were telephone cable, a 33,000-V trifurcating box, house-service boxes, "Fors" accumulators, and "Kalanite" insulating material.

Electric Heating and Hardware, Ltd.

This company exhibited an electric cooker designed along new and improved lines. In this the general wiring system is extremely simple, there being three solid terminals only passing through the lagging. These are protected by distance tubes and insulated from any moisture that may accumulate. The fuse-box is roomy and easily accessible, and all fuses and connections may be examined by sliding down the outside panel, which is secured by a wing nut. The insulation consists of steatite bushes throughout, no mica being used. The heating elements are of special design, being made up of small steatite formers built on racks, or grids. Each element is easily detached and is interchangeable, contact being made direct with bus-bars. Four elements are fitted on either side of the oven, and also two for bottom heat when required. Consequently, the elements cover practically the whole superficial area of the inner body, giving good distribution of heat at any loading.

Hackbridge Electric Construction Co., Ltd.

The principal exhibits on this stand were two large transformers, the first being a 2,000-kVA, three-phase, 50-cycle, 11,000-V oil-immersed self-cooled transformer, and the other a 250-kVA, three-phase, 50-cycle, 6,600-V, oil-immersed, self-contained pattern. Both transformers were of modern design and construction, and embodied many of the latest improvements. Another exhibit was a complete automatic voltage-regulating equipment, comprising switchgear and transformers connected up and operating, the switches being of the contactor type. There was also a display of transformer construction and assembly details, and a noticeable exhibit was the "Hackbridge" tapping switch, which represents a great advance in transformer tapping-switch design. Other plant displayed consisted of a standard tubular tank with rounded ends, and a standard type of mining tank.

Excelsior Shade Manufacturing Co.

This company, which reported good sales during the Fair, had a very comprehensive display of its latest designs in lamp shades. These vary in size from the small shade for a bracket to large and expensive shades for pendants. The fittings are of silk flounce over wire, constructed in the usual manner, while some of the heavier types are made with rings of oak or mahogany to match furniture. Beads and other types of decoration also play a prominent part in the designs.

I. Calvete, Ltd.

This company exhibited at both sections of the Fair. Its Birmingham display comprised ultra-violet apparatus, vibrators, and other electromedical apparatus. Radiant therapy lamps of various types were shown, and there was also an "Icall" blower incorporating a heating element. One novel feature was a combined massage and hair-clipping apparatus, in which the change of function was arranged for by changeable heads upon a flexible shaft.

Camille Espir.

This stand, although small, bore a beautiful display of decorative electrical fittings. These were of several kinds of material, such as "Erinoid," synthetic resin, "Celastoid," and wood, and included standards, pear switches, switch plates, ceiling roses, &c. Emphasis was laid upon the fact that all the electrical fittings for a room, from the switches to the lighting fittings, could be produced in the same design, a very unusual thing.

Thermo Path Co., Ltd.

Examples of the "Merocol" screen fire, described a short time ago in the ELECTRICAL REVIEW, were exhibited by this company. These, it will be remembered, are fire screens with a boss-type electric fire which, when not in use, can be covered in with an ornamental plate. Other types of electric fire were also shown, in addition to artistic floor and table standards for electric lighting, the "Windsor" electric oven, &c.

New Conveyor Co., Ltd.

One of this company's exhibits was a foundry sand-recovery plant, shown working. Driven by a 4-h.p. electric motor, this equipment comprises a band passing over two drums, one of which is of the electro-magnetic type made by the Rapid Magnetting Machine Co. This separates out the metallic particles from the sand, which passes to a jigging screen, from beneath which the sand is recovered.

Electrical Power Engineers' Association.

This exhibit drew attention to the beneficent work of the National Joint Board, to which the Association is a party, emphasising the important work of the board, particularly in respect of the training of electrical power engineers. In addition, the educational work of the Association through technical lectures and by articles in its *Journal* was stressed.

Electrical Power Engineering Co. (Birmingham), Ltd.

Motors, lighting plant, and pumps were shown by this company. The lighting set was of the "Warwick" type suitable for small country houses. A battery-charging set was shown, as well as an electric motor provided with "Fabroil" reduction gear.

Tubes, Ltd.

On this stand were exhibited various type of weldless steel tubes, boiler tubes, and steam pipes for high-pressure work, both for marine and power-house use. The boiler tubes are manufactured to meet various naval and marine specifications and requirements.

Young, Osmond & Young, Ltd.

This company again displayed short sections of its "Lightfoot" and "Unity" heating apparatus. This is of the tubular type with low, distributed loadings, the wires being enclosed in metal tubes for mounting along skirting boards, &c.

The "Ideal Home" Exhibition.

A review of the electrical features of this year's show at Olympia, London.

VISITORS to the Ideal Home Exhibition at Olympia, London, this year are finding that it has again surpassed the shows of the previous years in the collection of new methods and ideas for the housewife. Olympia itself is transformed with fresh decorative schemes, and a new mezzanine terrace is found at the end of the main hall. An attractive feature is a scene of rural charm in the new hall where a flower-fringed village stream borders a picturesque group of full-size furnished houses, one of which, a Tudor mansion, is the largest house ever built inside Olympia.

In the main hall a fountain court forms the centrepiece of a display of electrically lit furnished rooms, and the art of landscape gardening again transforms the annexe into a fascinating spectacle of spring. Another feature of interest may be seen in the Hall of British Handicrafts in the gallery, where the operation of a variety of old crafts is shown.

Our Dominions are represented by a great display staged by the Empire Marketing Board in the new hall gallery, where there is also a vast array of exhibits of other British commodities for replenishing the larder.

In connection with the lighting of Olympia this year for the Exhibition, some shades are in use which are believed to be unique in some respects. Fig. 1 is a general view of these.

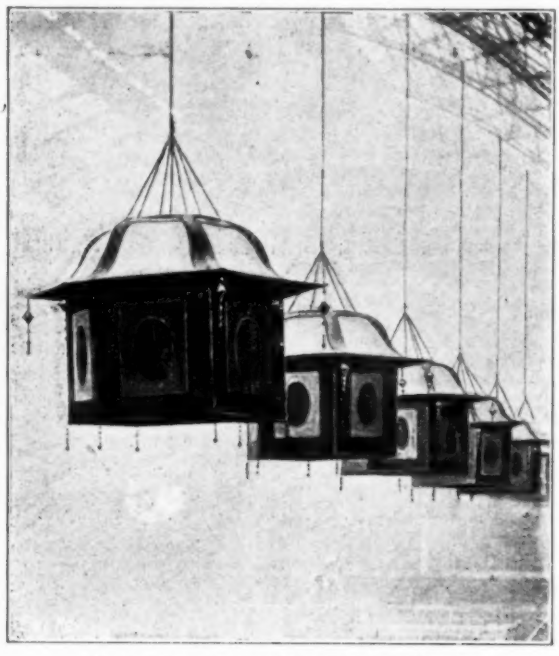


Fig. 1.—Large Electric Light Shades at Olympia.

There are 20 all told, and they are each 14 ft. in diameter and 16 ft. 6 in. high. Each is constructed on an iron framework, weighing about 3 cwt., which is covered with ordinary good-quality bed sheeting, hand sewn on to the frame work with special twine and copper wire. The outside and inside are dyed and painted respectively, orange and blue, the whole being efficiently fire proofed. The framework was made in sections at the workshops of the makers, Messrs. Walford Art Co., London, and assembled on the site. The shades are each equipped with two or three outside-type 1,000-W fittings, those already installed in the building, so that the illumination from each shade is four or six thousand c.p.

The shades are placed 55 ft. above the floor, measuring from the bottom of the shade. Each is carried by an 8-in. ring, by means of chains, and is suspended by two ¼-in. steel wires from the roof girders. Twenty fittings fixed above the shades illuminate their exterior, and result in a pleasing effect. The contractors for the work were Messrs. William McGeoch and Co., Ltd.

It is encouraging to note that the electrical industry is fairly well represented this year, although it is a pity that the Electrical Development Association has not found it possible to take part in the show as in previous years; on the whole credit is due to the electrical firms for their displays. It is also interesting to note that there is a general spirit of co-operation among the electrical firms in order to more effectively compete with the gas industry, which, by the way, is obviously making very great efforts. A new introduction is that of ultra-violet apparatus, which is not only shown by electrical firms, but is included in some of the general exhibits, of the more luxurious nature, as modern bathroom equipment. There is also the exhibit by the Zoological Society, London, of a working-model section of the new monkey house which is being constructed at the "Zoo." A portion of the cage is roofed with "Vitaglass" to admit the ultra-violet from high-c.p. incandescent "Lamplough" glass lamps. An electrically heated floor serves to keep the animals warm.

The following is a brief summary of the electrical exhibits:—

Reliance Telephone Co., Ltd.

The wide scope of the telephone and the degree to which it can be used to save labour is clearly demonstrated at this stand, where an all-British display shows that internal telephone communication is no longer the prerogative of offices and large hotels, and that it can be conveniently installed in clubs, flats, nursing homes, and private houses. On the Reliance service telephone system shown, calls can either be made from any floor or room to one central point, or, alternatively, the installation can be arranged so that every instrument can call directly every other instrument without the assistance of a switchboard operator. The Reliance auto-intercommunication system is somewhat similar, but is designed particularly for use in smaller offices, works, banks, hospitals, and so on. The Peel-Conner private automatic exchange telephone systems are represented by a 25-line and a 50-line Peel-Conner P.A.X. exchanges. The design of these allows for the incorporation of such special facilities as executive control, secretary's service, firm-alarm service, conference lines, and general code calls.

Belling & Co.

As might be expected, the outstanding feature of the exhibit by this firm is a comprehensive range of "Belling" electric fires. Included in these is a series of four imitation coal fires which have not yet been marketed. The multi-parabola fire-bar feature, common to the electric fires made by this firm, is being utilised in these new models, but to meet the different design requirements it is being made up in another form. The latest type of boiling plate adopted in the electric cookers by the company may be seen. It is a modification of the makers' "Honeycomb" plate (ELECTRICAL REVIEW, November 27th, 1925, p. 846). The fireclay through which the element spirals are threaded is now solid in one piece, and the bottom side of it is drilled so that small portions of the elements are exposed on this side. A feature of the new "Belling" cooker is its stainless-steel linings to the oven. A new model of the makers' cookerette is also exhibited. This is now made up as one unit, and a drop-down door is provided for the grilling chamber under the oven. For cooking demonstration work on this stand an ammeter graduated to show the consumption price per hour is proving attractive.

Francis Polden & Co., Ltd.

This firm is showing a complete Armstrong-Whitworth country-house lighting set of 1½ h.p. This is equipped with a "Wico" magneto, a separate model of which is shown working satisfactorily with water running over it. A recent introduction to the "Creda" cooker is also to be seen here; this is equipped with a white enamelled hob, and it is claimed that the special enamelling used stands up to the heat particularly well. Amongst all manner of lighting fittings, into which a very fine colour scheme is worked, are a number of triple-jointed bracket lamps, suitable for the local lighting of difficult spots, such as is required in dentistry.

Dowsing Radiant Heat Co., Ltd.

A variety of unusual electrical appliances may be seen on this stand. A number of bowl fires permanently and vertically set in cast frames are shown; also a combination of three bowl fires arranged triangularly on a framework, each bowl being arranged for tilting either up or down. An interesting exhibit in connection with electro-medical apparatus is the "Ultradescent." This provides both ultra-violet and heating, being equipped with tungsten filament and heating lamps. It is in the form of a polished-metal shroud for bed treatment. Various types of ultra-violet arc lamps and high-frequency apparatus are also shown.

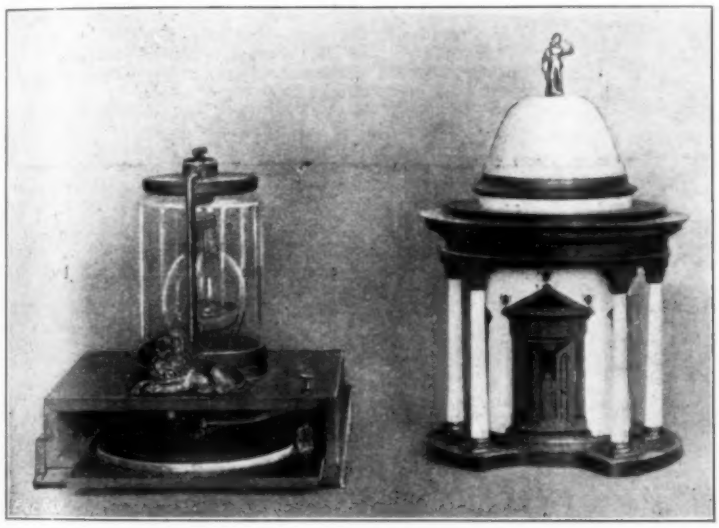
(To be continued.)

Illuminating Engineering.

Conditions governing good lighting: some street-lighting problems.

(*Résumé of Proceedings before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE ordinary meeting of the Institution of Electrical Engineers on March 3rd was preceded by a demonstration in the Common Room, by Mr. Ll. B. Atkinson, of a very old electro-pneumatic lamp. It consists of a glass vessel (fig. 1) wherein hydrogen gas is generated by the action of acid on zinc: on a lever being depressed, a jet of gas is liberated and simultaneously ignited by a spark from an electrophorus contained in the wood base of the instrument. The whole is housed within a decorated porcelain container (fig. 2) representing a "Temple of Venus," and is in an excellent state of preservation. The device was patented in 1807, and was made in Germany; it has been in the possession of Mr. Atkinson's family for over 100 years, and is an extremely rare specimen of its kind.



Figs. 1 and 2.—An Electro-pneumatic Lamp and Cover (right).

Two papers were presented (one of which is abstracted below), and a discussion followed, during which a draft B.E.S.A. specification for street lighting was outlined. Mr. H. T. Harrison's paper will be summarised in a forthcoming issue. Several different makes of photometer were exhibited.

Illuminating Engineering.—(*Abstract.*)

By JOHN W. T. WALSH, M.A., M.Sc., A.M.I.E.E.

The wide range of subjects, physics and engineering, physiology and psychology, coming within the purview of the illuminating engineer is pointed out. A brief *résumé* of the recent rapid progress in illumination is followed by a description of fundamental principles, in particular the use of the modern conception of luminous flux in illumination calculations.

What is emitted by any source of light is radiant energy in the form of waves capable of being appreciated by our eyes as light. The eye appraises this energy variously according to the wave-length in which it is conveyed, the maximum visual effect being produced at a wave-length of 555 millimicrons. Thus by appropriately weighting each wave-length, the rate of energy emission from a source can be expressed in terms of visual effect, or luminous flux. The lumen is defined as "equal to the flux emitted in unit solid angle* by a uniform point source of one international candle." If a point source of which the luminous intensity is 1 candle in every direction be placed at the centre of a sphere from which there has been removed an area equal to the square of the radius (fig. 3), and if all reflected light be neglected, the light flux which escapes from the opening in the sphere is equal to 1 lumen. If, now, the unit source be replaced by one having a luminous intensity of 1 candles in every direction lying within the cone shown shaded, the flux emitted within this cone is 1 lumens, and equally so if the *average* luminous intensity in this cone be 1 candles. Since the area of the whole surface of a sphere is $4\pi r^2$, the luminous flux emitted by a source is equal to $4\pi I$, where I is the luminous intensity if this is the same in all directions, or the average luminous intensity if the distribution be non-uniform (the practical case). This average luminous intensity in all directions in space is often termed the mean spherical candle-power, so that the luminous flux output in lumens is equal to the mean spherical candle-power multiplied by 4π.

The conception of luminous flux leads to a most convenient definition of illumination: if the luminous intensity of the source be 1 candle and the radius of the sphere 1 foot, the illumination of the interior surface of the sphere (reflected light being neglected) is everywhere equal to 1 foot-candle; but the area of the surface defined by the shaded cone is in this case 1 square foot, and the flux reaching it is 1 lumen; therefore, the illumination of a surface may be defined as the flux density, or flux per unit area, reaching that surface, the foot-candle thus being equal to 1 lumen per square foot.

Values were formerly invariably calculated by means of the inverse-square and cosine laws; now, however, the more usual procedure, at any rate in planning a general lighting system, is to multiply the area to be lighted (A square feet) by the illumination (E foot-candles); the useful flux required is thus AE lumens. A "utilisation factor" U is then applied to convert the "useful" lumens to the lumens actually emitted by the lamps. The value of the factor U ranges from about 0.2 to 0.6 according to the shape of the room to be lighted, the tone of the internal decoration, and the system of lighting employed. The luminous flux output required is thus AE/U and the number and rating of the lamps is chosen accordingly.

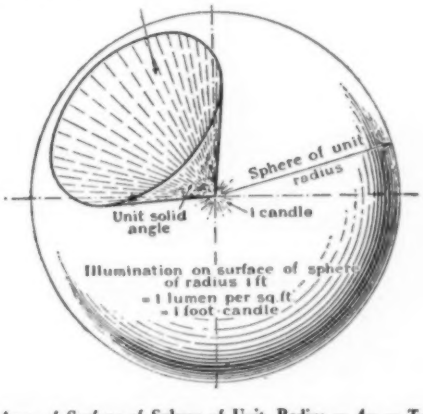

Sphere of unit radius
Unit solid angle
1 candle
Illumination on surface of sphere of radius 1 ft
= 1 lumen per sq ft
= 1 foot-candle

Fig. 3.—Area of Surface of Sphere of Unit Radius = 4π = Total Flux of Light from a Source of Unit m.s.c.p.

The photometric bench used for the measurement of candle-power, *i.e.*, the comparison of the luminous intensities of two sources of light in a fixed direction, is still the basic instrument in light measurement. The photometer head may take many different forms. All depend ultimately upon the capacity of the eye to judge when two contiguous surfaces presented to it are equally bright. The precision with which this judgment can be made governs absolutely the precision of all photometric measurement. The governing factor, then,

* The unit of solid angle, sometimes called the "steradian," is the angle subtended at the centre of a sphere by an area of the spherical surface equal to the square on the radius.

is psychological and not physical and is subject to the limitations of perceptual phenomena. The curve relating the lowest perceptible contrast in percentage ($100\delta_B/_B$) with absolute brightness for white light (actually the light of a flame lamp) is shown in fig. 4. The governing factor is not the brightness of the field looked at, but the brightness of the image formed on the retina; as the pupil of the eye enlarges at the lower values of field brightness, it would be unsatisfactory to plot values of field brightness as viewed by the eye with the natural pupil. The scale of abscissæ is therefore a scale of field brightness when the eye is covered with an artificial pupil having an area of 1 mm².† In ordinary photometric work the natural pupil is used up to a limit of about 10 mm² (the area of the artificial pupil in the usual Lummer-Brodhun head). A second scale of abscissæ has therefore been added to show the actual field brightness under normal working conditions *assuming an average value for the pupillary aperture at each brightness.* The quantitative effect of colour

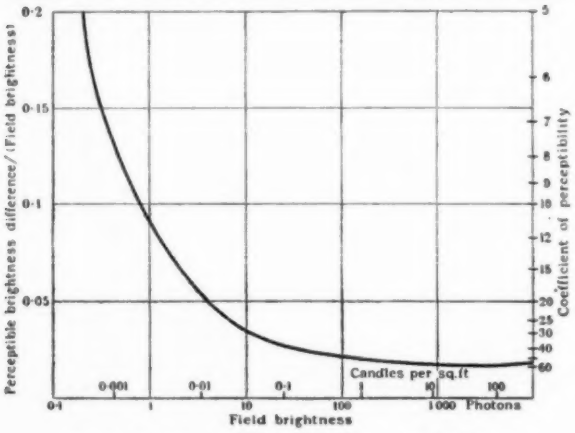


Fig. 4.—Variation of Contrast Sensitivity with Brightness.

difference has not been extensively studied, and no doubt it, like the other factors influencing an equality judgment, must depend markedly on the individual.

Essentially, there is no difference between the head used on a bench for the measurement of luminous intensity and the portable photometer used for illumination measurements. However, one class of illumination measurement demands special consideration; in streets, the light is incident at a small angle with the horizontal, especially at the point of minimum illumination. Large errors are therefore almost inevitable if any attempt be made to measure the illumination of a horizontal plane at this point in the ordinary way. The only satisfactory method of finding the horizontal illumination is to place the test surface so as to face each lamp in turn, and to measure the "normal" illumination due to that lamp in the ordinary way. The horizontal illumination can then be found by multiplying the value so measured by the sine of the angle which the light makes with the horizontal. Since this angle is usually small, the sine of the angle varies approximately as the angle itself, so that an accurate determination of the angle is essential. For street-lighting work, therefore, it is necessary to have, in addition to the photometer, a device for determining the angle which the rays from any light source make with the horizontal. Sometimes such a device is fitted to the photometer itself. In the new Holophane instrument it takes the form of a skeleton telescope and angular scale; when the instrument is levelled, the image of the source is focused on the cross-lines and the angle required is then read on the scale attached to the card-holder. The values of partial horizontal illumination thus calculated for each lamp are added to find the total horizontal illumination.

The brief description (in the paper) of some of the instruments used for the measurement of illumination, and of the errors inherent in this type of measurement, suffice to indicate the order of accuracy attainable in normal practice. With a satisfactory instrument, recently calibrated and carefully used, the precision may probably be put at about 8 to 10 per cent. for field work at normal values of illumination (1 foot-candle and upwards). As the illumination is reduced the precision falls, until for work in illumination of the order of 0.02 foot-candle (the illumination due to the full moon, a value not uncommon in street lighting) a precision better than 25 per cent. can hardly be hoped for.

Conditions Governing Good Lighting.—The factors governing design may be divided broadly into two main classes: the illumination must be *adequate* and the lighting must be *suitable*. The tendency to concentrate on adequacy without similar attention to suitability is a serious mistake: it is an easy matter to draw up a schedule of the illuminations considered necessary for different places or classes of work, and often nearly as easy to draw up a lighting scheme to give this necessary illumination, but careful consideration of the special requirements of each system as regards the placing of the light sources, the use of suitable shades or reflectors, the best scheme of interior decoration and the possible advantage of using light of some special colour, demands much more care, much experience, and constant touch with the rapid developments now taking place in the design of lighting equipment.

(*a*) *Adequacy.*—No excuse, then, is made for passing over "adequacy" in a few lines. Most books on illuminating engineering give tables of foot-candle values recommended for different purposes; in the author's personal opinion, however, the values given in such tables should be regarded as minima. Values double, or even treble, these can be employed with advantage in nearly every case, but always with the proviso that the system is planned with due regard to the principles explained in the paper. Most people will gladly work in daylight, which is often 5 or even 10 times as great as that they consider to be too high in the case of artificial light. The fact is that, generally speaking, the conditions under which daylight is received are immeasurably superior to those to which we are accustomed in the case of artificial lighting. Once again it is a matter of "suitability." The governing factor in determining visibility is not illumination, but brightness; therefore, in general, where the work is normally dark in tone, the illumination should be at least three times that allowed for in the tables of illumination values referred to above.

(*b*) *Freedom from Glare.*—Quantity of light is useless, or even harmful, unless it be properly distributed. The considerations which determine the suitability of any lighting system may be divided as follows:—

(*a*) Freedom from glare and from excessive contrast in the field of view.
(*b*) Adequate, but not excessive, diffusion.
(*c*) Correct colour.
(*d*) Correct proportion of local and general lighting.

Much has been written on the subject of glare, but very little that has materially advanced our knowledge of this complicated phenomenon. Glare is closely related to "ocular adaptation," and the remarkable constancy of the least perceptible brightness difference which, as can be seen from fig. 4, exists for a range of field brightness from 0.3 to 300 candles per square foot, is a striking example of the extremely wide range over which the eye is capable of almost complete adaptation. However, (*a*) values of field brightness often met with under artificial lighting conditions lie outside this range of complete adaptation, and (*b*) adaptation, even within a restricted range of brightness, is very far from instantaneous. The time (several seconds) taken for adaptation of the eye is, at least, a contributory cause of "successive glare," *i.e.*, the reduction of visual efficiency which results from allowing the eyes to view a bright source and so become adapted to a brightness level higher than that of the normal working field. The assumption that, as long as there are no sources of light situated in or close to the normal line of view, the lighting system is free from glare is very far from being correct. The eye almost certainly will wander over the whole room up to a certain angle of elevation. The first rule, therefore, for the avoidance of glare deals with the angle

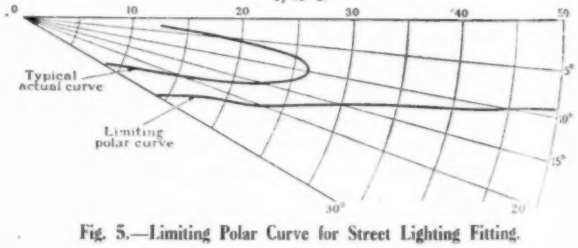


Fig. 5.—Limiting Polar Curve for Street Lighting Fitting.

of cut-off and may be stated thus:—"In any lighting system every light source or other bright surface visible to the eye should have an angular elevation of at least 20 deg., and preferably 30 deg., when viewed from any normal working position."

It has frequently been stated that the limiting brightness tolerable in the field of view is about 3 candles per square inch, and the definition given in the Factory Lighting Committee's report is 5 candles per square inch. Under normal daylight conditions the working illumination is usually much higher than that provided by artificial light, and it may quite well be the fact that to an eye adapted to a working illumination of 20 or 30 foot-candles, a brightness of 3 candles per square inch does not produce any noticeable glare. To the same eye adapted to a working illumination of one-tenth this amount, however, such a brightness in the field of view may produce a very distinct diminution of visual efficiency. The truth is that glare is a continuous phenomenon: it increases with the size as well as with the brightness of the glaring source, and it decreases progressively as this source is removed further and further from the line of fixation; all these conditions being fixed, it decreases as the brightness of the

† A field brightness of 1 candle per m² viewed through a pupil of 1 mm² area gives a retinal illumination of 1 photon.

normal field of view increases. The ideal conditions are those in which there is nothing in the field of view (*i.e.*, less than 30 deg. above the horizontal) brighter than the object requiring attention.

It might be thought that the ideal could easily be achieved by concentrating light on the point of work by means of some local fittings, leaving the remainder of the room in complete darkness, but this is a most undesirable arrangement. When the two fields differ markedly in brightness, the visual efficiency is lower than when both have a brightness equal to the smaller of the two previously employed; thus, when the brightnesses of the two fields are respectively about 7 and 0.3 candles per square foot, the visual efficiency is less than when the brightness of both fields is 0.3 candle per square foot. There must, then, be a further rule that the general level of illumination in the field of view should not be too low in comparison with that of the object requiring attention. The data available on the subject are really insufficient to indicate a figure for the greatest permissible ratio, but it is almost certain that one-twentieth is an outside limit, while one-tenth or even one-fifth is to be preferred. It should not be concluded from the two rules just given that a dead uniformity of brightness is to be aimed at. Moderate contrasts are pleasant; they are in fact the means by which the features in any scene are recognised. If it be allowable to take the contrasts commonly met with in nature as a guide, ratios not exceeding one-tenth are suggested, since the brightness of a grass field is approximately one-tenth that of the sky above it. Absolute uniformity of brightness in the visual field, if attainable, would be most tiring, since the eye would constantly be searching for relaxation and failing to find it. Once again, however, it is necessary to remember the distinction between brightness and illumination.

In every case the fight against glare must be waged with the utmost vigour. To say that surfaces having a brightness of 3 candles per square inch or over must not be tolerated in the normal field of view, may sound like a counsel of perfection to-day. The author ventures to prophesy that in 10 years' time it will be as much a truism as is the statement now that a bare electric lamp should not be visible in any properly lighted room.

(*c*) *Adequate Diffusion.*—The unpleasant effect of the hard shadows cast by a single source of light of small superficial area is familiar to everyone, but an almost complete absence of shadow, although suitable for a few purposes, such as drawing-office work, is most inconvenient for other work, such as sewing, for it is only by means of the shadows cast by the individual threads that the texture of the material can be seen. Each of the three systems, direct, indirect, and semi-indirect, has its own field of usefulness. The brightness of the diffusing material used for the bowls of semi-indirect fittings is generally of the order of 1 to 3 candles per square inch, and it is therefore sometimes concluded that there is no disadvantage in having such fittings within the normal field of view, but this is not the case and such fittings should be hung as high as is permissible.

(*d*) *Suitability of Colour.*—Deliberate colouration of the light involves the sacrifice of some part of the available flux. There is no doubt, however, that for certain purposes a modification of the colour of the light given by the lamps may be of very great advantage.

(*d*) *Correct Proportioning of Local and General Illumination.*—It is sometimes desired to have a very high illumination (of the order of 20 to 50 foot-candles) at the point of work in such fine processes as watchmaking, engraving, &c., and the only solution of the problem is to supplement the general illumination with local lighting. The contrast between the high level of brightness at the point of work and the comparative darkness of the room in general will cause a certain loss of efficiency, but this must be faced; it can be minimised by having the general illumination as high as possible, and in no case less than one-tenth of the illumination provided by the local lighting.

Street Lighting.—It has not yet been decided whether it is more important to illuminate the vertical surfaces of objects in a roadway, or the horizontal surface of the road itself; both are concerned in rendering objects visible to the driver of a vehicle. An object must be seen by contrast with the road surface which forms its background. The brightness of this background is almost certainly variable from one part to another, and the higher the general level of brightness, at least up to a limit of 0.7 candle per square foot (a level much higher than that met with in any street) the more sensitive is the eye to small differences of brightness (see fig. 4), *i.e.*, the smaller the contrast detectable. The conclusion that excellence in street lighting could be achieved by having as high an illumination as possible, with an adequate diversity of brightness so as to ensure a good contrast with objects, whether light or dark, ignores the all-important factor of glare. The following is an attempt to apply such experimental data on glare as we possess to a problem in which glare exercises an almost preponderating influence.

For any source which is of such a size that its maximum linear dimension subtends an angle of less than 3 degs. at the eye, the brightness and the size need not be considered separately, but the glaring effect may be regarded as due simply to the effective candle-power in the direction of view. The glare, then, is governed by the following four factors:—

(*a*) The candle-power in the direction considered.
(*b*) The distance of the source from the point considered.
(*c*) The angle of elevation.
(*d*) The general brightness of the field of view, *i.e.*, in practice, of the street surface.

Since the visibilty of objects depends very largely on the sensitivity of the eye to contrast, take as the criterion of glare the reciprocal of the brightness contrast just perceptible to the eye. This "coefficient of perceptibility" $p = B/(B - B')$, where B and B' are the brightnesses which can just be distinguished from each other; from fig. 4, the maximum value of p attainable under conditions of "no glare" is about 60 at normal values of brightness. The scale of ordinates on the right of that figure shows how p diminishes as the general field brightness is decreased. The variation of p with the candle-power of the glaring source and its distance from the observer may be expressed by means of a curve showing the relation between p and the illuminatin E produced by the glaring source at the observer's eye. It is necessary to determine the relation between p and the angle α between the lines joining the observer's eye to the glaring source and to the object respectively. A relation may then be found giving p in terms of both α and E; in other words, for constant glare conditions the relation between E and α is fixed. If, further, it be agreed to measure α from the horizontal plane passing through the observer's eye (say, the 5-ft. plane), there is for the fitting a limiting polar curve corresponding to any given mounting, for $\tan \alpha = (h - 5)/d$, where h is the mounting height and d the horizontal distance of the observer from the standard. Further, $E = (I_\alpha \cos \alpha)/d^2$ or, approximately, $E = I_\alpha a^2/(57)^2(h-5)^2$, where a is in degrees. Hence a relation can be found which gives $I_\alpha/(h - 5)^2$ for every value of α. The figures may be put in the form of a polar curve, as has been done in fig. 5, which shows the maximum limiting values of $1/(h - 5)^2$, so that, for a given mounting height, the outer limits of the polar curve are determined for the fitting; alternatively, if the polar curve be fixed, the minimum mounting height may be determined. The above method of limiting the amount of glare must be used in conjunction with a specified street illumination. The figures calculated have all been based on the assumption of a field brightness of not less than 0.07 candle per square foot. Taking the reflection factor of the roadway as of the order of 10 per cent., this means that the average illumination must be at least 0.7 foot-candle. Assuming a round figure of about 9 for the diversity factor, *i.e.*, the ratio of maximum to minimum illumination, this means that the horizontal illumination due to a single lamp midway between the standards must be at least 0.3 foot-candle at the road surface. If the ratio of spacing to height be r, the value of α at the midway point is arc tan $(2/r)$, while the illumination at this point is $(I_\alpha \sin \alpha)/h^2(1+r^2/4)$. This consideration fixes a maximum value of r for a given value of h and a given polar curve.

For example, with a specified minimum illumination of 0.3 foot-candle, fig. 5 shows that the maximum permissible value of r with a mounting height of 15 ft. is about 6.5; with a mounting height of 40 ft., however, r may be nearly as high as 9.

The above treatment of glare in the case of street lighting is novel so far as the author is aware, and, as it was developed in connection with the preparation of a proposed British Standard Specification for Street Lighting, it is an example of an attempt to apply the results of what was primarily a psychological investigation to a practical illuminating engineering problem.

Conclusion.—With the opinion that many modern lighting installations providing an illumination of 3 or 5 foot-candles represent the saturation point, at least so far as load is concerned, the author does not agree. Far higher degrees of illumination will be found advantageous so long as proper care is taken to ensure that the light provided is used in the right way.

It may well be that a proper distribution of the light provided, or a desirable modification of its spectral distribution, may result in a utilisation factor far lower than that commonly attained at the present time. Such an apparently wasteful system may, in reality, be the best when the psychological factors are given due weight in the problem, and there is every indication that the economic value of good lighting is such that even a large increase in lighting costs may be far outweighed by the benefits resulting from increased economic efficiency. It is not too much to say that 90 per cent. of people in this country carry on their work after daylight hours by inadequate illumination and an unsuitable system of lighting. A quadrupled lighting load, properly employed, would result in better health, physically and mentally, and its cost would be trifling compared with the benefits it would confer on every class of the community.

Discussion in London.

Mr. C. C. PATERSON opened the discussion by outlining the scope of the British Engineering Standards Association's draft Specification for Street Lighting, which was equally applicable to electric and gas lighting, and referring to the subjective aspect of the subject. The effect on the eye itself was apt to be forgotten, and when considering street lighting the eye was used very near its limit without a factor of safety. The authors of both papers had been very active members of the B.E.S.A. Committee (of which Mr. Paterson was chairman)

that had framed the specification; it had worked for two years with very few data of real value to guide it, but its findings had been unanimous. He appealed to all concerned to read the preface (copies of the draft specification had been handed to all members attending the meeting) carefully, the last paragraph of which was worded as follows:—"There is no doubt in the minds of those responsible for this specification that during the next few years the trend will, and should, be towards higher and better distributed street illumination, and the standards have been set to anticipate the immediate future rather than to stereotype the past." There was at present no criterion to go by in street lighting, no accepted standard, and the Committee had laid down a classification that would not hinder future progress. The mandatory clauses were few and simple, Nos. 8 and 10, which dealt respectively with the classification of installations and the minimum service illumination; all the other clauses had been framed mainly to make the two aforementioned ones practical. The specification was nothing more than a first step, but, if adopted, it would carry the subject forward.

Mr. F. Bailey agreed with the views put forward by Mr. H. T. Harrison in his paper. The City of London's lighting was so good because it had been thoroughly tested and considered; they had had a year's experience of it before it was put into public use. Central suspension of the lamps over the streets was the right method: he had had to alter the design of lamp standards so that when they were knocked down by vehicles they would not fly into pieces, and so that they would know where they would fall, and what they would do when they reached the ground. The quality of the city's lighting was revealed by the number of foreign visitors who came to view it, and their appreciation. England produced the finest plant and did the finest work; a wave of pessimism had spread over the country to which he objected strongly.

Mr. W. J. Jones emphasised the fact that the eye was the final court of appeal. Mr. J. W. T. Walsh's paper teemed with suggestive passages, but with regard to that which implied that a brightness of 3 per cent. would result in glare, care must be exercised when defining the upper limit when diffusing fittings were used; the author had been somewhat adventurous in prophesying the limit of brightness for future fittings, for each installation must be considered on its merits. The speaker looked forward to the time when street lighting would be judged in terms of visibility, and it would not be long, he thought, before such a criterion would be available. "The more light we have amongst us, the happier we will be."

Mr. Leon Gaster was gratified to hear the subject of illuminating engineering discussed before the I.E.E., for it was not so long since he was a "crier in the wilderness." Thanks to the National Physical Laboratory and the scientific research in progress, the subject was now being dealt with in an authoritative manner which would convince the public. He stressed the educational aspect of the matter: there was no justification for anyone to call himself an electrical engineer or architect unless he possessed knowledge of illumination, and illumination engineers had not been able to convince such people that they could help them. Perhaps Mr. J. W. T. Walsh, who was a member of the I.E.E. Council, would draw that body's attention to the need for more illuminating education.

Mr. P. Good was not surprised at the length of time taken by the B.E.S.A. Committee to produce the street lighting specification; valuable help had been rendered by the G.E.C. Research Laboratory and the E.L.M.A. Lighting Service Bureau, and in view of the large amount of work that had been done he thought the Committee had achieved its aim quickly. To put more wires over streets would be a retrograde step. Those concerned with street lighting talked too much about its cost, and it was time they began to talk of its cheapness; three times the present amount of light could be obtained for a very small additional cost. Darkness, dirt, and crime were very closely associated.

Mr. R. C. Fox, speaking as a student, said that totally indirect lighting had a somewhat dismal effect, though it seemed to reduce eyestrain. That the central suspension arrangement was the best form of street lighting was shown by the City of London's installation. It would seem that the side streets merited consideration first, for the illumination of main thoroughfares was contributed to by shop-window light: when the shops closed main-street traffic decreased as people moved homewards through the side streets, thus increasing traffic danger therein due to lack of light. In college he had found a lack of technical instruction on illumination; the subject was inadequately provided for, and most of what he knew about lighting he had had to pick up outside college hours.

Capt. W. J. Liberty was of the opinion that overhead suspension was the ideal method of lighting streets. In Cheapside the number of every motor-car, no matter how fast or slowly it was travelling, could be seen; a pin could be seen on the surface of the road, and one could read a newspaper comfortably. When standards at the roadside were used half the light was wasted on the walls of buildings where it was not wanted. It had been his pleasant duty to distribute the B.E.S.A. specification to town authorities all over England; a conference representative of neighbouring towns had been called by the Sheffield city authorities to urge the official adoption of the specification, which was being given serious consideration everywhere. He hoped that everyone interested in the matter would record his opinion of the specification, so as to assist those responsible for drafting it to form an idea of what was required.

Mr. D. Dixon pointed out that the eye was the final judge, but that which pleased it was not necessarily always good for it. Habit was an important factor, as witnessed the public's general reluctance to employ artificial daylight.

Mr. T. J. Sack thought that Mr. H. T. Harrison's suggested method of suspending street-lighting fittings overhead would prove embarrassing to fire brigades. The present method of allowing motorists to provide their own light on the highways was most uneconomical; it meant that something like 90 million watts were "careering round the country" wastefully. Each car carried its own little lighting system, which cost on an average about £20, representing a total capital investment of about £18,000,000; if that amount of money had been used to build large generating plant, it would have sufficed to provide one light per mile of highway throughout the country.

Mr. J. W. T. Walsh, in reply, remarked that three candles per sq. in. could be intensely glaring. There was a lack of data on glare, but the Department of Scientific and Industrial Research had an investigation on that subject very much in hand, and before long results would become available. Not "the more," but "the better light there is amongst us, the happier we will be." He endorsed what Mr. L. Gaster had said about education and illumination; in the I.E.E. membership examination illumination was at present a part subject only, whereas it should really be made a whole subject. The reason why many people disliked artificial daylight, and characterised it as depressing, was because they did not use enough of it: 20 or 30, even 50, ft.-candles would not be harmful, for they were used to very much higher figures in the case of natural daylight.

Mr. H. T. Harrison, also in reply, explained that the small wires he proposed for overhead street lighting would not be readily visible at a height of 30 ft.; tramway wires were four times as large as those he proposed to employ, and yet people had become accustomed to them. No more obstruction would be caused to fire brigades than was experienced to-day with tramway wires.

Finally, Mr. C. C. Paterson expressed gratification at the manner in which the draft B.E.S.A. Specification for Street Lighting had been received by the meeting, and at the way it was being taken up seriously elsewhere in the country as indicated by Capt. Liberty's remarks.

(To be continued.)

Correspondence.

***Correspondents should forward their communications as early as possible.** No letter can be published unless we have the writer's name and address in our possession.*

The "H" Type of Cable.

I have read with interest the letter by Mr. G. H. Nisbett on page 1074 of your December 31st, 1926, issue, and also the replies thereto published in two subsequent issues. While most of the questions have been covered adequately in this correspondence, there are still one or two points which might be mentioned, and I would appreciate a small amount of space in your columns to take up a few of them.

To begin with, Mr. Nisbett is entirely correct in stating that there is nothing very new about Type "H" cable, which dates back to 1914. I may state that my company has been the pioneer in this field. It has held a licence for this form of cable for the United States since 1913, has been investigating its properties since that time, and has been actively engaged in manufacturing Type "H" cables for the voltage range of 25 kV to 35 kV for the last eight years.

I find difficulty in following some of Mr. Nisbett's arguments. The recent work of Farmer, of the Electrical Testing Laboratories at New York, has shown (*Journal* of A.I.E.E., 1926, p. 454) that the weak points of ordinary belted three-conductor cable when exposed for a long time to high voltage are in the filler spaces and at the surface of the conductor insulation towards the cable centre, these regions giving way and carbonising first, and leading to eventual puncture and complete breakdown. He comes to the conclusion that the long-time breakdown strength of cables in which the stress is radial is 50 per cent. or more of that of the belted type of cable.* Obviously the long-time breakdown strength of a cable with radial stresses is not infinitely high, and the mere use of the Höchstädter metallised surfaces does not eliminate all cable troubles. Still, a device which will so greatly increase the breakdown strength for long-time high voltage, or even give an increase very much smaller than that, seems to be well worth while.

Mr. Nisbett claims that Type "H" cable is larger than the belted type. My company has made large quantities of this type of cable and has a large amount in actual successful service. Its general policy is to make the Type "H" cables at least as small as a comparable belted cable, because it is possible

* As written; apparently it should read "50 per cent. more than that," &c.—Eds.

to use the conductor insulation in a more rational way, and therefore use higher stresses. The alleged mechanical difficulty of cabling together the three conductors without a surrounding belt has been entirely satisfactorily solved by methods we have employed.

The question of relative current-carrying capacities in Type "H" and belted cables does not seem to be entirely clear in the correspondence, possibly because there has been too much generalisation. To draw any conclusion, it is necessary to know how the metal is applied to the insulated conductors, how thick it is, what its thermal resistivity is, and how many adjacent cables there are. Our own policy is normally to use around each of the insulated conductors copper foil about 0.003 in., which is usually specified in this country. We then apply over the three twisted conductors a thin steel foil, so that the metal coating of the conductor insulation is in general in thermal contact with the lead sheath. Using this construction, and in view of the fact that copper has about double the thermal conductivity of aluminium, we find that the temperature rise of the conductors above the lead sheath for a given size of conductor and current is about half as much in a Type "H" cable as in a belted cable. The actual percentage gain in current-carrying capacity is, of course, a function of how large a percentage the rise between conductors and lead is of the total rise of the conductors, which depends upon conditions of installation, number of adjacent cables, &c.

With regard to the relative dielectric losses, there are two points of view. The first is probably the more important, namely, that, due to the better design of the Type "H" cable, the ionisation curve is likely to be flatter, and thus the power factor of Type "H" cable at high voltage will be lower than that of a belted cable. Any such difference is also likely to be accentuated further during service when the cable has been put through temperature cycles, resulting in still further ionisation and high power factor and loss for the belted type of cable.

Neglecting the higher ionisation losses in belted cable, we may, however, consider the relative losses in a Type "H" cable and a belted cable on the basis of equal power factor of insulation. On this basis, we usually find that the loss in the Type "H" cable is slightly higher than that in a belted cable, due to the fact that higher working stresses may be used in the Type "H" cable. However, the main effect of dielectric loss is a reduction in permissible current-carrying capacity due to the heating from dielectric loss, and the excellent thermal characteristics of the Type "H" cable more than compensate for the slightly higher losses therein, resulting in a total temperature rise due to dielectric loss (regardless of conductor losses) less for Type "H" than for a belted cable.

The reason for this is twofold. To begin with, the temperature rise between conductor and lead of a single-conductor cable or of a Type "H" cable is half as much for a given loss in the dielectric as for the same loss in the conductors (Archiv für Elektrotechnik, 1922, Vol. 11, p. 68), while it is approximately the same for both types of losses for a belted cable. Furthermore, as stated above, the thermal resistance between the conductors and lead of a Type "H" cable properly designed is about half of that in the corresponding belted cable. These two facts together mean that the temperature rise between conductors and lead due to dielectric loss for a Type "H" cable is about *one-quarter* that of the belted cable, and the usual effect of this is to make the total temperature rise due to dielectric loss for a Type "H" cable less than that in a belted cable, even neglecting the increase of power factor and loss in the belted cable due to ionisation.

Donald M. Simons,
Development Engineer, STANDARD UNDERGROUND CABLE CO.

Pittsburgh, Pa., *February 21st*, 1927.

Extra-High-Pressure Transmission.

Mr. A. T. Scott's letter in your issue of February 25th is not by any means a complete answer to mine in the issue of February 7th. He ignores the point I made that two overhead lines at, say, 33,000 volts, can be provided at less than the cost of one underground cable. One might develop this further. It is admitted that a single 33,000-volt cable is not reliable enough. Would two overhead lines be considered adequate? If so, the question is settled. If not, why not have four overhead lines, which will be cheaper than two underground cables? Surely four overhead circuits will be safe, or even three with specially large insulators.

Having in mind recent e.h.p. cable troubles, I deny that overhead construction practice has not kept pace with cable design.

Mr. Scott's statement as to the cleaning of all insulators being necessary eventually is interesting, but I hope inaccurate. In this country we get rain at least once a month, and this means that we have an insulator with half its surface cleaned each month without the help of a cleaning gang. The surface exposed to rain may be made sufficient to resist wet flash-over, assuming the under surface to be so dirty that it is ineffective; such an insulator will not flash over in a fog, even after a long spell of dry weather, during which it has become dirty.

It is known that 3,300-volt and even 6,600-volt insulators never need cleaning in England in open country, even in manufacturing districts, and I have many 33,000-volt insulators which have not been touched for 3½ years. These are in a mixed residential, manufacturing, and agricultural area, and they are only "2-shed." We have had to change some near railways, chemical works, &c., for the "3-shed" type, and none of these has, so far, flashed over. Any real quantitative information which can be obtained on this subject will be welcome, but we hope to be spared qualitative generalities such as those Mr. Scott has provided.

It is interesting to find that Mr. Scott has been misled by my reference to G.P.O. practice, because I purposely followed his indirect form of expression on this point. It shows how desirable it is to adopt downright and forthright methods. I understand that the Post Office has found underground cables unsatisfactory for trunk lines, and declines to put important lines underground whenever they can go overhead. In other words, while Mr. Scott may have been right in advising us to follow its example, he was wrong in imagining its policy to be one of putting important routes underground.

W. Fennell.

Northwich, *February 28th*, 1927.

The Earthing of Portable Domestic Appliances.

I am afraid Mr. Joseph has missed the point of my article. It is not a case of "making too much fuss about the whole business," but rather a matter of giving complete satisfaction to the owner of the installation.

I am all against unnecessary restrictions and regulations; we suffer from a surfeit of them already in the electrical industry. But since most, if not all, of the fatalities in private houses due to electric shock have occurred in bathrooms, it is incumbent on the profession to make the use of electrical appliances in such places as safe as possible, and I think the majority of engineers will agree with me on this point.

As regards rendering portable appliances safe in bathrooms, this usually means earthing, since, with the majority of apparatus, it is impossible to enclose the metallic framework completely with insulating material. This can only be done effectively by using a 3-core flex with a 3-pin earthed plug-socket, because if the ordinary 2-pin plug-socket is used and a separate earthing lead is installed, the latter connection may be forgotten or overlooked when the appliance is plugged in. Therefore, when a plug-socket is to be fixed in a bathroom, it must of necessity be of the 3-pin type, and this is just where the disadvantage and inconvenience to the owner of the installation comes in. If all the other plug-points in the house are of the 2-pin type (and from the point of view of safety there is no reason why they should not be) apparatus used in the bathroom cannot be utilised in the other rooms, and *vice-versa*. Numerous consumers have complained to me of this decided disadvantage. Naturally, they wish to be able to use any particular appliance in any part of the house and not to be restricted to certain rooms.

The only way out of this difficulty, in my opinion, is, as I have suggested, to provide 3-pin plug-sockets at all plug points. Apart from the bathroom, or other situations where a shock to earth is thought to be dangerous, it is not necessary to connect the third socket to earth, although if lead-covered wiring or steel conduit is used it would take very little more labour to make such a connection. If C.T.S. is used for the installation, my method would be to provide 3-pin plug-sockets throughout and only make an earth connection from a convenient water pipe to the socket fixed in the bathroom.

Therefore, in my opinion, the whole thing boils down to this: If no plug is required in the bathroom, 2-pin plug-sockets will suffice throughout the house; but if portable apparatus is to be used in the bathroom (and with the ever-increasing use of electricity it will undoubtedly be wanted in such places in the near future), then 3-pin plug-sockets must be fitted in all the rooms for the purposes of interchangeability.

I am glad "A.M.I.E.E." supports my views. He complains, however, that some supply authorities do not apparently practise what they preach, by not earthing their supply services and meters. I can assure him, nevertheless, that owing to the special nature of such gear, opinion is very much divided on the advisability of earthing this particular class of apparatus.

Reg. H. Rawll, A.M.I.E.E.

Birmingham, *March 1st*, 1927.

Kiosk-type Sub-Stations.

As manufacturers of kiosk-type sub-stations, we were interested in the remarks of your correspondent "P.M.W." on this subject in your issue of February 25th. We have always appreciated the fact that adequate screening of e.h.p. parts is essential, and would refer your correspondent to the article on our design of kiosk in your issue of December 17th, page 1009. The illustration clearly shows that not only has the e.h.p. apparatus been screened from accidental contact from the outside of the kiosk, but the various circuits and apparatus have been partitioned off so that adequate protection is given when working on any section. We do not favour the interlocking of kiosk doors, as this gives a false idea of security. A very elaborate system of interlocking and the earth-

ing of the power transformer, both on the e.h.p. and l.p. sides, would have to be undertaken to give really complete foolproof protection. Totally enclosed metal-clad e.h.p. switchgear has been advocated, but whilst this is good in principle, capital cost in the big majority of cases rules it out. We trust that "P.M.W." will now appreciate that even if our contemporaries have not pleased him, we always give attention to the points he raises.

We will certainly provide our customers with all essential safeguards, but it should be recognised that much is asked and but little paid, for anything in the way of super safety devices sometimes specified and sometimes only suggested as an afterthought.

W. H. Holding.

Manchester, *March 1st*, 1927.

Your correspondent "P.M.W." will perhaps be interested to learn that at least one manufacturer is in a position to meet the conditions laid down by him, at an economic price, by completely immersing not only the automatic switches, but also the isolators (which are of the quick-make-and-break type), bus-bars, current transformers, &c., in oil.

The e.h.p. switchgear is in the same compartment of the kiosk as the transformer, and there is no necessity for the added complication of interlocked doors. The l.p. gear is in a separate compartment entered by a special door at the side.

There is absolutely no risk of accidental contact with the e.h.p. apparatus, and, further, cleaning of bus-bars and isolating switches, together with their insulators, is entirely eliminated; also the gear is unaffected by deleterious atmospheric conditions.

This switchgear has been successfully in service in this country for the past seven years, and is available for the largest capacity systems. The writer would be glad to furnish full details to "P.M.W." or any other engineer interested.

P. Nutter,
Engineer, Coq Switchgear Co.

Newcastle-on-Tyne, *February 26th*, 1927.

A Metering Problem.

It is rather difficult to diagnose the trouble experienced by your correspondent "E.H.K.P.," because, as is almost unavoidable in cases of this nature, all the information necessary to ensure arrival at the correct conclusion is not available. However, the appended remarks may be of some interest.

(1) It would appear that the Supply Authority, being convinced that the Aron meter was registering considerably less energy than was supplied to the consumer, was confronted with the problem of metering the load correctly, and, at the same time, convincing the consumer that the Aron meter readings were hopelessly low.

Presumably, to serve this dual purpose, a carefully calibrated Sangamo equipment was then installed with the Aron meter operating from the same instrument transformers. Admittedly, the introduction of the additional load of the Aron meter would interfere with the fine accuracy of the Sangamo equipment and the Aron meter would not be compensated for the ratio and phase-angle errors of the Sangamo transformers, but the inaccuracies thus introduced would be negligible compared with the difference in reading of 4,000 units—approximately 10 per cent. of the energy consumed by the factory when working at full load for seven 24-hour days. Apparently, therefore, the Supply Authority justified its contention regarding the inaccuracy of the Aron meter.

(2) Although the introduction of the third meter is not explained, probably the consumer would not admit that the Company had proved its case, and the third meter was put in circuit with the other two in order to "make assurance doubly sure." We are told, however, that none of the three meters read alike, but the most important information—namely, the *percentage* inaccuracy of the third meter, taking the Sangamo meter as correct—is not given.

It is quite possible for there to be a considerable difference in the actual readings of two meters, both of which are accurate within prescribed tolerances. Let us assume that, when all three meters were in circuit, the Sangamo meter was 2½ per cent. fast and the third meter 2½ per cent. slow. If the actual units consumed during the test period were 24,000 (approximately half load on the factory for seven 24-hour days), the Sangamo meter would read 24,600 units, and the third meter 23,400 units—an actual difference of 1,200 units. Although both meters would be within the limits prescribed by the B.E.S.A. specification for meters calibrated with their instrument transformers, it is easy to see that, without some explanation, the Company would have difficulty in persuading its client that a difference of over 1,000 units was permissible in the readings of two meters claimed to be accurate.

(3) Provided that the difference in the readings of the two check meters was of an order which could be accounted for by some explanation such as that given above, the Company's proposal to charge the consumer for the period when the Aron meter was in circuit on the basis of the units registered by the Sangamo meter during a similar period would appear to be the fairest method of dealing with the matter, since the Supply Authority could hardly be expected to present the consumer with energy at the rate of 4,000 units per week, even for a short period, and, in addition, bear the expense of the preparation and installation of check outfits. Of course, the most convincing way of demonstrating the inaccuracy of the Aron equipment would have been to have left the complete outfit in circuit and installed the complete Check Sangamo equipment alongside it, but, possibly, conditions on site precluded the adoption of this method.

(4) To guard against troubles of this nature it is very useful for consumers who take a heavy load to install their own meters on the various sub-circuits. The summation of the readings of these meters then serves as a useful check on the Supply Company's meter, and, moreover, the individual meter readings are very valuable for departmental costing purposes.

(5) One method of simplifying the equipment installed in the case under consideration would be to use meters with pressure coils connected directly to the line. Several manufacturers of high-grade polyphase watt-hour meters arrange the pressure coils of their meters suitable for direct connection to voltages up to and including 650 across phases.

Frank Rostron.

Oldham, *March 4th*, 1927.

I read with great interest in your "Correspondence" columns the letter on the subject of "A Metering Problem." I am more than surprised to notice that the test department that is responsible for the accuracy of meters on consumers' circuits appears to treat this subject so lightly. I should like to point out the utter foolishness of connecting two different meters on the same current and potential transformers, when they were designed for their own transformers.

Further, the error was increased by inserting a portable test meter again on the transformers which were already wrongly connected, so obviously the test was useless. The subject of metering is most important for consumer and supply company also.

We all like to know what we are paying for, so the test departments should possess men that know what they are about.

D. M. Duncan.

Walthamstow, *March 4th*, 1927.

A Knotty Problem.

Your correspondent "Perplexed" is like the man who could not choose a suit owing to the tailor showing him too many patterns.

As an experienced electrical contractor, however, I should certainly plump for C.T.S. of the original manufacture. This system is the cheapest and best. It is ideal for wiring buildings already occupied, as it disturbs the place least, takes up very little room, and is quickly installed—hence the cheapness.

If "Perplexed" should be in the Manchester area I should be happy to quote him for his work and assure him that the work will be to his present and lasting satisfaction.

J. H. Fletcher.

Manchester, *March 3rd*, 1927.

Power Supply for Wireless Sets.

I note the further letter from "Interested" in your issue for March 4th, and see therefrom that your correspondent is apparently prepared to go further with the matter of a comparative test.

It will be remembered that your correspondent claimed "equal performance." The first test which I would suggest is a simple aural one. Obviously the sets must be compared on the same loud-speaker, and since their output impedance probably differs this is difficult to arrange. I therefore suggest that the output from each set be switched in turn on to a choke-coupled high-power amplifier of first-class quality, the output of which is applied to a Rice-Kellogg loud-speaker. Should your correspondent agree to carry out the test, I hope that I may be able to obtain permission to use apparatus of this type which I know to be in the possession of Messrs. Burndept. The amplifier in question has a substantially flat response curve between about 40 and 9,000 cycles, and can deal with input swings up to 120 volts or more. If the last valve of "Interested's" set is of higher impedance than that in the set which I propose to try against it, I should of course agree to his using a larger coupling choke in proportion, in order that the frequency response of the amplifier may be the same in either case. In this way it will be simple for both sets to be tested under the same conditions, *viz.*, with an output swing of about 150 volts, which is the maximum undistorted swing obtainable on my set.

Since the test is essentially one of *quality of reproduction*, it is of course essential that it should be carried out quite near to the broadcast station, in order that no questions of strength or selectivity should enter into the test conditions. If "Interested" agrees, I would suggest asking permission of Messrs. Burndept Wireless, Ltd., to carry out the test in their research department. Arrangements would, of course, be made for those who are to judge the quality to listen to the sets with rapid change-over arrangements, and without knowing which set is in operation.

I feel myself fairly confident that the results of trying to obtain output swings of 150 volts with only 120 volts h.p. will definitely convince "Interested" that his claim to equal performance cannot be maintained. If this is not the case, however, it will be necessary to carry out further tests. These

should comprise (1) a measurement test on pure sine-wave input, so as to obtain a frequency response curve of the type given in my original article, and (2) some form of wave-form test at an output of about 150 volts swing. Unfortunately, I do not know where I can obtain the loan of an oscillograph, which would be the simplest method of making this test, but failing this there is a fairly simple method of finding whether there are any strong harmonics, details of which I will give you if you desire them.

It will, of course, be appreciated that "Interested's" claim for equal performance must be interpreted to mean (1) that in spite of its three transformers, his set will reproduce notes in the extreme bass (*i.e.*, down to 30 cycles) as well as the one which I shall produce, and (2) that in spite of its limitation to 120 volts h.p., his set will give no more wave-form distortion than mine, with an output swing of 150 volts in each case.

P. K. Turner.

Blackheath, *March 4th*, 1927.

What is it to Drive?

We are surprised to read in the article under the above heading in your issue of March 4th, that purchasers of motors are recommended to add 20 per cent. to published horse-powers, as machine makers cut the horse-power to a minimum, leaving no safety margin.

This may be necessary when one is purchasing motors from Continental manufacturers, or certain manufacturers in this country who deliberately cut their ratings, but if motors are purchased from reputable firms who not only promise on paper that their motors comply with B.E.S.A. 168 but deliver motors that on test do comply with this specification, then there is no need for the distrust in ratings which your correspondent implies.

On a.c. motors particularly, it is inadvisable to adopt the course he suggests, as otherwise power factors tend to be low when the motors are running on light loads.

The Lancashire Dynamo and Motor Co., Ltd.

G. E. MASON, *Director*.

Manchester, *March 5th*, 1927.

[The "published horse-power" in question is, of course, the rating of the machine that is to be driven by the motor.—EDS. ELEC. REV.]

The Salaries of Engineers.

May I express complete agreement with the remarks on the above subject by your two previous correspondents?

"Yet Another Poor-Blighter" suggests that the I.E.E. Council should consider the advisability of fixing minimum salaries for electrical engineers; may I go a step further, and suggest that a little critical self-examination on the part of members who occupy administrative positions in manufacturing companies might go a long way in improving the monetary reward given to members of their technical staffs?

Having in mind the highly critical capabilities of members, displayed at meetings of the I.E.E. on technical subjects, it seems a pity that a discussion has not been raised on electrical engineers' salaries; it would be an amusing, if somewhat pathetic, sight, to see some of the aforementioned administrators endeavouring to explain away the fact that many qualified members of their technical staffs were receiving "salaries" considerably less than hands employed in their workshops, and this in spite of the ever-increasing dividends paid by companies manufacturing electrical equipment.

And Yet One More.

March 4th, 1927.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

16,174. "Thermo-electric generators for energising the filament and plate circuits of wireless receiving sets and the like." H. A. Roberts. March 22nd, 1926. (269,519.)

19,981. "Method of producing high permeability in magnetic material." Standard Telephones and Cables Ltd. (Bell Telephone Laboratories, Inc.). August 8th, 1925. (265,642.)

22,486. "Electric switches." J. C. White. September 9th, 1925. (265,645.)

23,398. "Mechanism for operating electric oil switches or for analogous purposes." J. G. Statter and G. S. Marston. July 12th, 1926. (265,647.)

23,841. "Traffic control lamps." M. J. Raymond. December 30th, 1925. (265,648.)

25,260. "Current rectifiers." L. Levy. October 9th, 1925. (265,652.)

25,277. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. October 9th, 1925. (265,653.)

25,611. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and A. J. Kay. October 13th, 1925. (Addition to 246,550.) (265,657.)

26,498. "Safety apparatus for electrically-driven pumps." Rees Roturbo Manufacturing Co., Ltd., and C. F. Belcenn. October 22nd, 1925. (265,660.)

27,023. "Remote control systems." Coventry Automatic Telephones, Ltd., and J. E. Collyer. October 28th, 1925. (265,661.)

27,048. "Loud-speaking telephonic apparatus." M. Graham and A. Graham (legal representatives of F. A. Graham, deceased). October 28th, 1925. (265,662.)

27,663. "Automatic and semi-automatic telephone systems." Standard Telephones and Cables, Ltd., J. H. E. Baker, A. J. Chanter and W. R. Moscrip. November 3rd, 1925. (265,666.)

27,782. "Telephone systems." Standard Telephones and Cables, Ltd., J. H. E. Baker and J. R. Hardwick. November 4th, 1925. (265,668.)

28,031. "Electrolytic oxidation of organic compounds." C. H. Field. November 7th, 1925 (265,672.)

28,153. "Maximum-demand meters for alternating current." G. F. Shotter and E. W. Hill. November 9th, 1925. (Cognate application 19,016/26.) (265,673.)

28,191. "Grid leaks, variable condensers, and resistances for use in connection with radio apparatus." R. H. Winter and H. C. Daly. November 9th, 1925. (265,676.)

28,216. "Telephone systems." Standard Telephones and Cables, Ltd., J. H. E. Baker and J. R. Hardwick. November 9th, 1925. (265,678.)

28,303. "Electric heating units." L. Satchwell. November 10th, 1925. (265,684.)

28,625. "Amplifier for four-wire connection with heavily loaded lines." J. W. Kirkland (Allegemeine Elektricitäts Ges.). November 13th, 1925. (265,693.)

28,674. "Automatic and semi automatic telephone systems." Standard Telephones and Cables, Ltd., R. A. Moir and G. C. Hartley. November 13th, 1925. (265,695.)

28,779. "Control knobs." P. C. Rushen (Pacent Electric Co., Inc.). November 14th, 1925. (265,698.)

28,968. "Braking of vehicles and more especially of electric tramway and other cars." W. E. Ireland. November 17th, 1925. (265,700.)

29,187. "Crystal receiving sets." H. F. Pattinson, C. T. O'Callaghan and W. C. Waghorne. November 19th, 1925. (265,705.)

29,330. "Manufacture of evacuated vessels such as thermionic valves." General Elctric Co., Ltd., and S. M. Duke. November 20th, 1925. (265,711.)

29,403. "Electric switches." J. B. Tucker. November 21st, 1925. (265,712.)

30,128. "Deviation indicating apparatus for railless vehicles for overhead wire electric traction." Brecknell, Munro & Rogers, Ltd., and A. M. Willis. November 28th, 1925. (265,722.)

30,433. "Electromagnets and solenoids." H. Cooch. December 2nd, 1925. (265,725.)

31,187. "Telephone systems." Siemens Bros. & Co., Ltd., and H. E. Humphries. December 10th, 1925. (265,732.)

31,802. "Holders for electric incandescent lamps." W. E. Grant and M. B. Bean. December 16th, 1925. (265,739.)

31,919. "Dynamo-electric machines." J. A. Kuyser and Metropolitan-Vickers Electrical Co., Ltd. December 17th, 1925. (265,740.)

32,346. "Sockets for receiving and supporting plug-in vacuum tubes." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). December 22nd, 1925. (265,743.)

32,483. "Vapour condensers." H. L. Guy and Metropolitan-Vickers Electrical Co., Ltd. December 23rd, 1925. (265,745.)

1926.

502. "Illuminated signs." E. J. Mathews. January 7th, 1926. (265,751.)

3,796. "Means for containing and connecting electric batteries." H. A. Yoward. February 10th, 1926. (265,773.)

4,263. "Electronic discharge devices." Raytheon Manufacturing Co. March 5th, 1925. (248,721.)

7,032. "Electric lamps." T. J. Digby. March 13th, 1926. (265,801.)

8,433. "Multi-channel telegraphy." F. E. Pernot. August 15th, 1925. (Divided application on 20,528/25.) (265,806.)

8,866. "Intermittently operating electric regulators." Allmanna Svenska Elektriska Aktiebolaget. April 3rd, 1925. (250,257.)

9,441. "Telegraph submarine cable with loading coils." Felten and Guilleaume Carlswerk Akt. Ges. June 11th, 1925. (253,483.)

10,779. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. December 29th, 1925. (263,736.)

11,703. "Means for closing and disinfecting the mouthpieces of telephone transmitters." W. H. Wintle. May 4th, 1926. (265,823.)

12,642. "Process for the electrolytic separation of metallic chromium." R. Appel. May 17th, 1926. (Addition to 259,118.) (265,833.)

14,246. "Inductance coils." M. Barengolz. June 7th, 1926. (265,836.)

14,570. "Illuminated signs." Patent-Treuhand Ges. fur Elektrische Gluhlampen. October 31st, 1925. (260,548.)

16,459. "Method of manufacturing hollow conductors." Dr. A. L. Mond (Metallbank und Metallurgische Akt. Ges.). June 30th, 1926. (265,849.)

16,559. "Electron discharge apparatus." British Thomson-Houston Co., Ltd. July 1st, 1925. (254,731.)

18,261. "Protection of supply systems from high voltage surges and the like." Sieverts Kabelverk, M. Sieverts Fabriks Aktiebolag. August 19th, 1925. (257,236.)

20,172. "Control systems for dynamo-electric machinery." Metropolitan-Vickers Electrical Co., Ltd. August 25th, 1925. (257,595.)

21,432. "Electromagnetic operating means." British Thomson-Houston Co., Ltd. August 31st, 1925. (257,632.)

24,238. "Electrical apparatus for heating liquids." Santon, Ltd., and H. C. Sanders. October 1st, 1926. (265,883.)

29,055. "Wireless telegraphy and telephony." Marconi's Wireless Telegraph Co., Ltd. November 18th, 1925. (261,758.)

29,525. "Oil-cooling means for oil-immersed electrical apparatus." Maschinenfabrik Oerlikon. December 2nd, 1925. (262,414.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 2nd. In the case of foreign applications, the names and addresses of the British representatives are also given:—

Supronic. No. 476,822. Class 5. Wire.—L.P.S. Electrical Co., Ltd., Avenue Road, Acton, W.3.

Pyromic. No. 477,406. Class 5. Unwrought and partly wrought metals used in manufactures.—Telegraph Construction and Maintenance Co., Ltd..

S.S. Protos (lettering and design). No. 472,257. All goods in Class 6. No. 472,258. All goods in Class 8. No. 472,259. All goods in Class 18. No. 472,260. All goods in Class 18. No. 472,261. All goods in Class 22.—Siemens-Schuckertwerke Gesellschaft, Berlin. (Haseltine, Lake & Co., 28, Southampton Buildings, W.C.2.)

Paradyne (lettering and design). No. 471,276. Class 8. Radio and electrical apparatus and sound-reproducing instruments.—Paradyne Manufacturing Co., 27, Elgin Road, Seven Kings, Essex.

Silveroid. No. 473,533. Class 8. Instruments and apparatus made from a nickel alloy.—Henry Wiggin & Co., Ltd.

Ton (lettering and Bear design). No. 475,122. Class 8. Parts of apparatus for radio-telegraphy and telephony, but not including electric cells and batteries or goods of a like nature.—C. F. & H. Burton, Bernard Street, Walsall.

Ohmrat Rut. No. 475,205. Class 8. Instruments and apparatus for use in radio-telegraphy and telephony.—Naamlooze Vennootschap Ramla Union, Enschede, Holland. (J. Martin Blair, Amberley House, Norfolk Street, Strand, W.C.2.)

Macilaphone. No. 476,584. Class 8. Telephone transmitter attachments for muffling sound.—E. McCann, Thanet House, 231, Strand, W.C.2.

Ancabe VI (lettering and design). No. 476,556. Class 8. Electric cables.—Callender's Cable and Construction Co., Ltd

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

AYR.—352 houses, for Corporation; burgh surveyor.

AYRSHIRE.—Extension to hosiery manufacturing company's factory at Irvine (£6,500); the manager. Entertainment pavilion, four verandahs, shelters, &c. (£4,000), for Town Council of Saltcoats; burgh surveyor.

BARTON-ON-IRWELL (Manchester). — Hospital, Davyhulme (£92,000), for the B.G.; the clerk.

BECKENHAM.—60 houses, Elmers End estate; Universal Housing Co., Ltd.

BEDDINGTON AND WALLINGTON.—Housing scheme (40), Bute Road estate, for the U.D.C.; S. F. R. Carter, surveyor.

BEXHILL.—Houses, Warwick Road and Cooden Drive; J. E. Maynard, Collington Avenue. Subway, Terminus Road, for Corporation and railway company; R. Robinson and Co.

BIRMINGHAM.—Museum; Corporation Museums Committee.

BLACKPOOL.—Extension of Victoria Hospital (£100,000); J. S. Gibson & Gordon, architects, Old Bond Street, London.

BOLTON.—182 houses, Moorfield estate; A. Braithwaite and Co., Ltd., Leeds. 102 houses, Moorfield estate; J. W. Lee, Ltd., Chorley.

BOURNEMOUTH.—Schools, Moordown, for the managers of St. Walburga's Roman Catholic schools; Preston and Redman, architects.

BRADFORD.—326 houses for Corporation at No. 6 housing scheme (Eccleshill); city architect, Town Hall.

BRIGHTON.—Reconstruction of Richmond Street and Circus Street schools (£20,500), for the borough E.C.; director of education.

BURSLEM.—Electrical installation, New George Hotel; Longden & Venables, architects.

CAMBORNE (Cornwall).—Additional 50 houses, for the U.D.C.; surveyor.

CHELMSFORD.—Additional 50 houses, for the T.C.; borough engineer.

CHISLEHURST.—Factory, offices, &c., Cray Road, for the Crittall Manufacturing Co., Ltd., Braintree.

DALSERF.—Additional 50 houses, for Lanarkshire C.C.; housing architect.

DEAL.—Additional housing scheme (48), for the T.C.; borough surveyor.

DEWSBURY.—Infirmary (£90,000); Infirmary Board.

DUDLEY.—Highway depôt extension, Griffin Street, borough engineer.

DUNDEE.—Two schools, for education authority; master of works.

FORRES.—Reconstruction of mansion, for Sir Alexander Grant, Edinburgh; Mr. Alastair MacDonald, architect, London.

GUILDFORD.—Council offices, with central heating, for the R.D.C.; J. W. Wilton, surveyor, Market Chambers, Onslow Street. Extensions, Haydon Place; Guildford Glass Works.

HAMILTON.—Town planning scheme, including 44 houses; burgh surveyor.

HATFIELD.—Additional 40 houses, for the R.D.C.; A. Sidwell, surveyor.

HIGH WYCOMBE.—Municipal offices, for the R.D.C.; C. H. Wright, architect, 3, Bourbon Street, Aylesbury.

HOLMFIRTH.—Children's ward, Holme Valley Memorial Hospital, with electrical work; P. N. Brown, architect, Hollowgate. Warehouse, Ford Mills; Kirk, Sons and Ridgway, architects, Market Place, Dewsbury.

HONITON.—84 houses, for the R.D.C.; clerk to the Council.

HULL.—Technical college (£150,000); Education Committee.

HUNTINGDON.—Showrooms and offices, for the Hunts., Cambs. and Beds. Electricity Co., Ltd.; Pettits, Ltd., builders.

ILKLEY.—56 houses; borough engineer.

KINGSTON-ON-THAMES.—Additional 58 houses, for the T.C.; borough surveyor. Boys' schools (£41,850), for Surrey E.C.; W. W. Finny, secretary.

LANCASTER.—146 houses, various estates; borough engineer.

LICHFIELD.—Extensions, including assembly hall, dining hall, laboratory, &c., Friary school, for Staffs. E.C.; F. A. Hughes, director of education, Stafford.

LINCOLN.—Extensions (new pavilion), city hospital, for the T.C.; S. C. Baggott, city engineer.

LONAN.—Schools (£13,450), for Isle of Man E.C.; William McArd, builder, Port Erin.

LONDON (Barking, E.).—Wesleyan mission hall (£52,000); Gelder & Kitchen, architects, Hull; Myall Bros., builders, Ilford. 40 houses, Hertford Road; Scriven and Huxtable. Electrification of additional machinery, Barking Town Works; W. Warbe & Co. Sewerage and electric pumping plant; U.D.C. surveyor.

(Becontree, E.).—Synagogue, Becontree Avenue; Hebrew Congregation.

(Ilford, E.).—Modernising lighting on stage, Town Hall; borough engineer. Isolation Hospital extensions; borough engineer. Church, Eastern Avenue; G. Baines and Sons.

(Leyton, E.).—Schools, Canterbury Road (£18,850), for the Borough E.C.; director of education.

(Walthamstow, E.).—36 houses, Forest Road; U.D.C. surveyor.

(Whitechapel, E.).—Roman Catholic central school, Lucas Street; Canon T. J. Ring.

(Highgate, N.).—Extensions, Furnishing Trades Benevolent Association's Homes (£10,000); secretary.

(Cricklewood, N.W.).—Garage and showrooms, Willesden Lane; G. A. Sexton & Son. Boiler house and chimney stack, North Circular Road, for Allen-Liversidge, Ltd.; Heron, Rogers & Pettit.

(Willesden, N.W.).—Extensions for McVitie & Price, Ltd., Waxlow Road; Willard, Son & Ellingham.

(Bermondsey, S.E.).—Motor buildings, Riley Street, for Henry Grant & Co., Ltd.; W. Figg.

(Rotherhithe, S.E.).—Flats, Boss Street, for Courage and Co., Ltd.; F. M. Kirby.

(Wandsworth, S.W.).—Housing scheme (80), for the T.C.; surveyor.

(Wimbledon, S.W.).—Catholic church, Arthur Road; Elkins and Co., Ltd.

MANCHESTER.—College of Technology; Education Committee (competition for designs).

MERTHYR.—Housing schemes for borough architect (300).

MILTON REGIS (Kent).—Municipal offices, for the U.D.C.; surveyor.

NEWRY (Co. Down).—40 houses for the U.D.C. (£11,000).

NEWTON ABBOT.—54 houses at Broadlands Housing Estate, for the U.D.C.

PORTSMOUTH.—Extensions, Grammar School (£20,000), for the governors; the clerk. New R.C. church at Cosham, and central hall; Rt. Rev. W. T. Cotter, St. John's Cathedral.

PUDSEY.—96 houses for Corporation, at Southroyd Park Estate; Basil H. Noble, borough surveyor, Town Hall.

RAMSEY.—Secondary schools, for Isle of Man E.C.; director of education, Douglas.

SEAHAM HARBOUR.—Housing scheme (80), for the U.D.C.; J. B. Abbey, surveyor.

SHEFFIELD.—Café, sale-room, offices and house, Exchange Street and Waingate; Brightside and Carbrook Co-operative Society, Ltd. Market hall (£35 000), near Exchange Street; city architect. 175 houses, Wadsley Hall Estate; Sutton trustees.

SOUTHAMPTON.—Hostel for Seamen; secretary, British Sailors' Society. Additional block, South Stoneham House, Swaythling, for University College; G. Grant, registrar.

SOUTH SHIELDS.—55 houses, Mortimer Road; T. A. Page and Son, architects.

STOKE.—Laboratory, water cooling tower, pump house and reservoir, Michelin Works; Michelin Tyre Co.

STOURBRIDGE.—Wesleyan church (£10,000); Crouch, Butler and Savage, architects, Birmingham.

WOLSTANTON (Staffs.).—Electrical installation, Chelmsford Road; Burslem and District Co-operative Society, Ltd.